ED 032 772

EM 007 424

By-Pryluck, Calvin

Structure and Function in Educational Cinema. Final Report.

Purdue Univ., Lafayette, Ind.

Spons Agency-Office of Education (DHEW), Washington, D.C. Bureau of Research.

Bureau No-BR-7-E-081

Pub Date 15 Apr 69

Grant-OEG-3-7-078135-3139

Note-79p.

EDRS Price MF-$0.50 HC-$4.05

Descriptors-Codification, Cognitive Processes, Communication (Thought Transfer), Concept Teaching, Educational Experience, *Films, *Film Study, *Instructional Films, *Learning Experience, Media Research, Nonverbal Communication, *Semiotics, Structural Analysis, Symbolic Language, Symbolic Learning

Teaching with films has largely been limited to the attainment of the simpler educational objectives such as factual and perceptual motor skills learning. Here is an attempt to define the characteristics of filmic communication in order that it may be applied to more complex educational aims. Language and filmic symbolism are compared to facilitate coding through varying levels of complexity. Problems raised by this form of structural analysis are discussed within the framework of the codification. A functional analysis is also made of filmic communication, in which film is conceived of as a system of implementation with the potential for the conceptual manipulation of the environment. It is felt that the effects of filmic communication are accountable to a process termed coding transformation, during which the characteristics of the symbol system transform experience in such a way as to supplement individual cognitive processes. It is also felt that the inherent characteristic of film as a symbol system is its inductive nature, which is highly valuable in communicating those aspects of educational development such as discovery, inquiry training, reflective teaching, hypothetical mode or, generically, inductive teaching. References, tables, coding models and schematic diagrams are presented. (SH)

ED0 32772

FINAL REPORT

Project No. 7-E-081
Grant No. OEG 3-7-078135-3139

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Calvin Pryluck

Purdue University
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U.S. DEPARTMENT OF
HEALTH, EDUCATION AND WELFARE

Office of Education
Bureau of Research

EM007424

Final Report

Project No. 7-E-081
Grant No. OEG 3-7-078135-3139

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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The research reported herein was performed pursuant to a grant with the Office of Education, U. S. Department of Health, Education, and Welfare. Contractors undertaking such projects under Government sponsorship are encouraged to express freely their professional judgment in the conduct of the project. Points of view or opinions stated do not, therefore, necessarily represent official Office of Education position or policy.

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CONTENTS

Preface ii

Summary 1

I The problem 3

II Analysis of filmic communication. 7

III Symbol systems and transmission channels. 11

IV General symbol systems. 21

V Systems of implementation 42

VI Coding transformations. 48

VII Conclusion and recommendations. 65

References. 67

PREFACE

The work reported on the following pages is an attempt at an empirically viable integration of the insights of film aesthetics with the conceptual requirements of scientific investigation in the field of education. The attempt to study these apparently discrete domains caused a filmmaker colleague to ask accusingly, "Are you talking about art or science?" The uneasy answer had to be both, although the investigator was more qualified in the former than the latter. The epistemological bias of the educational filmmaker responsible for this study was that if science and art are not consonant, one of them is wrong. The intuitions of art often foreshadow the findings of science, but good science could carry us further in our understanding. Nothing developed during the course of this study has caused me to change my mind; if anything, confidence in this position has been strengthened by the moral and intellectual support offered by colleagues in both domains.

Thanks are due to my colleagues at the Purdue University Educational and Research Film Unit; Karl B. Lohmann, Jr., Roy Mills, Wesley Phillippi, Vernon Putnam, and the unit administrator, Jesse L. Senn, Jr., who supported the work by asserting their conception of film while questioning mine and, in a practical way, by doing my share of the unit work on more than one occasion. Among the faculty of Purdue, thanks are due to Mary P. Endres and Ernest D. McDaniel, of the Department of Education and Joseph Rubinstein of the Department of Psychology. Special thanks are due Professor Warren F. Seibert, Head, Instructional Media Research Unit of the Purdue University Audio Visual Center who was always willing to listen even when I wasn't sure what I was talking about. Thanks beyond measure are due Edward P. McCoy, Professor of Communications and Head, Film Production at Michigan State University and Richard E. Snow, Assistant Professor of Education, Stanford University who may recognize more of their ideas than I've been able to acknowledge.

April, 1969
Philadelphia, Pa.

Calvin Pryluck

An aeroplane is not a bad motor-car
because you can't drive it on a road.
Bela Belazs
Theory of the Film
(1958)

Film technique fails to exhibit any superiority
over teaching techniques which it merely duplicates.
Phillip Justin Rulon
The Sound Motion Picture in Science Teaching
(1933)

SUMMARY

Research and utilization of motion pictures and related forms of communication (filmic communication) have largely been limited to the attainment of the simpler educational objectives such as factual and perceptual motor skills learning. An attempt has been made to conceptualize the unique and shared characteristics of filmic communication as they apply to the attainment of complex educational objectives.

A multi-stage process model of codification encompassing language and filmic communication is proposed to facilitate comparative analysis of two major symbol systems. Codification is seen as a hierarchical process through different levels of complexity. At the level of primary coding, film is proposed as differing from language in terms of the specificity of the former as compared with the generality of the latter. At the level of secondary coding, the specific nature of filmic primary coding units is generalized through sequencing, while the general nature of words is specified through sequencing. The general symbol system of filmic communication (film) is further defined by the addition of a sound track with multiple sound inputs in determinate relationship to the sequenced images.

The fundamental problems in research and utilization raised by this analysis of the structure of filmic communication include: 1) at the primary coding level, the relative contribution to meaning of filmic coding variables (expression) and content; 2) at the secondary coding level, the effect of serial juxtaposition between primary coding units; 3) at the general symbol system level, the effects of lateral juxtaposition between sound and picture simultaneously presented.

In the functional analysis of filmic communication, film is conceived of as a system of implementation with the potential for the conceptual manipulation of the environment. The inherent structural characteristics detailed in the structural analysis can be organized into various imposed structures which mediate between individual cognition and the environment for two classes of experience, direct experience and contrived experience not otherwise available.

It is proposed that the obtained and hypothesized effects of filmic communication in education can be accounted for through a process termed coding transformation by which the inherent and imposed characteristics of a symbol system transform experience to supplement individual cognitive processes relative to instructional objectives. It is further proposed that the essential inherent characteristic of film as a symbol system is its inductive nature leading to a convergence of filmic and pedagogical theories based on conceptions that underlay the educational

developments variously called discovery, inquiry training, reflective teaching, hypothetical mode or, generically, inductive teaching. Selected research studies and educational films are interpreted in the presented framework.

The fundamental problem in research and utilization raised by the analysis of functions of filmic communication concern, generally, the operation of the coding transformation and, specifically, the extent to which students can make inferences from filmic communication.

I

THE PROBLEM

Extensive research and practical experience has demonstrated to the level of "high certainty" that films are effective in perceptual motor learning and factual learning. The research evidence is much less certain on the capacity of film to teach "those rational activities unique to man—conceptualization, critical thinking, generalization, etc." (Hoban, 1960, pp. 103-105). As part of Hoban's et cetera, we might add other activities unique to man—those generally subsumed under the rubric of affect. In terms of hard evidence, we know relatively little about the effect of filmic communication on those activities that should properly be the central concern of educators.

Relating cause and effect in historical events is a tricky business, but it may be useful to speculate a bit on the reasons why we know a great deal about the relationship between filmic communication and fairly simple instructional tasks and relatively little about how film might contribute to the more important instructional events.

An important reason for this gap seems to be that it falls between the two major traditions of film scholarship in the United States. For writers in the aesthetic tradition, education was often explicitly excluded from their concern, while writers in the tradition of behaviorist psychology limited their investigations to those aspects of film that could be incorporated into existing psychological theory. Important contributions have been made by these two lines of descent: the aesthetic, from poet Vachel Lindsay (1915) to Pauline Kael (1965) and behaviorist psychology, from Lashley and Watson (1922), Freeman et al (1924) to Gropper (1963, 1965) and Travers (1964). But between the light shed by these separate theoretical inclinations there remains an area of darkness. What might be found in this obscurity was intuitively perceived by Bruner (1966) when he asked in his essays on a theory of instruction: "Why did Last Year at Marienbad abrade the curiosity so well?" (p. 99).

While the aesthetic tradition might be able to answer this particular question for this particular film it doesn't seem to be able to answer more general questions relative to the utilization of film for complex instructional objectives. Neither, it seems, can the behaviorist tradition. George A. Miller's (1962) criticism of the latter with respect to the study of language can apply equally well to the study of film. He notes that in the study of language, there has been much research which emphasizes "the general similarities, rather than the specific differences between linguistic and other skills. . . ."

> I have no quarrel with that approach as long as we recognize that it treats only the simplest 1% of the psycholinguistic problem, and that our crucially important human skill in arranging symbols in novel and useful combinations is largely ignored by successive reductions of language to meaning to reference to conditioning (p. 748).

In a subsequent paper, Miller (1965) elaborated on the empirical hazards facing an investigator who uses preexisting generalizations and orientations in some quite different area:

> One's theoretical preconceptions can be badly misleading. Trivial features may be unduly emphasized, while crucially important aspects may be postponed, neglected, or even overlooked entirely. . . .
>
> . . . [When research] is not guided by a valid conception of the new phenonema to be explained, much intelligent enterprise can end in frustration and discouragement (p. 15).

The history of audiovisual research lends support to Miller's contentions. Lacking an adequate description of the phenomenon, previous studies have either tended to use variables that were not particular to audiovisual phenomena (inserted questions, response patterns, readability of commentary, etc.) or gross, otherwise undefined, filmic variables (color, movement, "dramatic presentation," etc.) In keeping with sound experimental practice, many of the earlier investigators formulated hypotheses in terms of a single apparent characteristic of motion pictures, e.g., "color should be an advantage if it is one of the most relevant cues. . ." (Neal E. Miller, 1957, p. 83. See also May and Lumsdaine, 1958, p. 9 for similar formulation).

Not surprisingly in retrospect, the results of these studies were so mixed that empirical evidence of some sort is available to support almost any position regarding filmic communication one's biases incline him to. As we hope to make clear in this report, one of the reasons for this general lack of success is that the films used in these studies did not in fact, utilize the unique features of filmic communication. Here as in other areas of science, the obvious is not necessarily true. Color vs. monochrome or motion picture vs. still photograph, are not necessarily the most relevant aspects of filmic communication even if they are the most obvious.

Having been misled by their theoretical preconceptions with respect to film, learning-theory-oriented investigators have apparently retreated from any attempt at a valid conceptualization of the phenomenon of filmic communication. Instead of questioning the faulty conceptualization that led to inadequate results some investigators seem to have compounded the error by denying that there is a unique phenomenon involved. Filmic communication, in this conception, is essentially a transmission channel; the aesthetic assumption of film as a unique method of communicating experience is deemed a trivial side-issue.

In a typical one of these analyses by Knowlton (1964), film is one of several "message-mediating vehicles" and "anything that could be said about a message-mediating vehicle independently of messages is already well known, and not very interesting in any case" (p. 39). He thus sidesteps any necessity to investigate the ways in which the vehicle actually mediates the message.

Travers (1964) avoids the issue in a somewhat similar fashion. He views as debatable "The proposition that visual teaching materials involve a language of communication and represent a channel of communication distinct from ordinary language" (p. 1.20). Travers then proceeds to argue that there is no such thing as a visual language, without ever referring to the second and more crucial part of the proposition: the distinction between language and visual communication as systems of communication.

As generally formulated, the question of visual language is indeed a trivial problem. There is no particular point in debating whether visuals do or do not constitute a "language." Using any accepted definition of language, it is obvious that visuals per se are not language. The critical question is whether visual communication and, particularly, motion pictures and the like have the capacity to mediate the environment in ways which are uniquely different from the similar capacity of verbal languages. The balance of this report will detail the considerations which suggest that there are important systematic differences and will attempt to suggest the relevance of these differences to the educational enterprise.

Filmic communication is here seen as being a complex symbol system encompassing several types of information transmitted simultaneously through two modalities. A more formal definition of filmic communication would be: Filmic communication is the controlled exposure through mechanical means of sequenced images typically in determinate relationship to speech, music, and sound. As defined, then, filmic communication subsumes motion pictures, television, filmstrips, and other multimedia presentations including certain computer assisted instructional systems such as the IBM 1500 which has the capacity for the simultaneous presentation of print, audio, and pictorial image.

By ignoring the complexity of filmic communication, research in the learning theory tradition has been able to adduce limited findings which bear only marginal resemblance to filmic communication as commonly experienced. The scientific cautions apply to the study of filmic communication as well as to the study of any other phenomena. If one makes too many or the wrong simplifying assumptions the phenomenon will elude our grasp altogether.

Attempts to derive answers directly from the aesthetic tradition do not seem to be any more promising. Aesthetics has been concerned with normative prescription; but in an area as dynamically unstable as film, aesthetic imperatives quickly become negated by example. In 1912, a columnist in a motion picture trade magazine commented on "the tendency of many motion pictures to cut the feet of the actors out of the scene." "If this tendencykeeps up," he warned his readers, "we shall soon be seeing nothing of the actor but his head and shoulders" (Hoffman, 1912). Similar bad guesses about what film is or will be are found in much of the aesthetic literature. This kind of normative prescription seems to be orthogonal to the scientific precision of learning theory.

The apparent incompatibility of learning theory and aesthetics has led otherwise capable researchers into scientific blind alleys. Summing up his experience as a member of C. R. Carpenter's film research group at Pennsylvania State University in the early fifties, Roshal (1960) noted:

> I believe that we have failed . . . in coming to grips with the filmic essence. . . . I, as many other colleagues have, have read Belazs, and Eisenstein, Benoit-Levy and [other film theorists] and we have not been able to translate their ideas into testable propositions (p. 117).

This failure is not surprising. Any attempt to bridge learning theory and aesthetics from their present positions is equally likely to fail: they operate from different universes of discourse. As presently constituted, neither approach is able to comply with the research requirements implied by Hoban (1960) in his review of "The usable residue of educational film research":

> The creative nature of film-making increases the difficulty of film research, since (a) independent variables are embedded in an art-form, and (b) the art of film-making itself is a variable. In the creative process, the artist, knowingly or unknowingly, may introduce additional variables which have not yet been identified as variables in theory or research (p. 104).

Learning theory does not at present seem capable of manipulating independent variables embedded in an art-form; aesthetic theory has not demonstrated itself capable of accounting for a continually evolving coding system.

A substantial start toward a psychological theory of complex symbolic behavior seems to have been made by the work of such cognitive theorists as Guilford (1967), Bruner (1964), G. A. Miller (1962), and related works by Berlyne (1965) and Reitman (1965) to list only a few of the more obvious citations. The work toward a scientifically adequate description of filmic communication consists of a few scattered papers and dissertations, e.g., Gregory (1961), Penn (1967), Pryluck and Snow (1967), Rose (1964), Salomon and Snow (1968), Worth (1966, 1968).

II

ANALYSIS OF FILMIC COMMUNICATIONS

The present work is a preliminary attempt at an empirically viable conceptualization of the phenomenon of filmic communication. In general, it is an attempt to conform the scientific demand for precision of description with the looser, but still insightful, observations of aesthetics. Readers familiar with the aesthetic literature may find some of the formulations a bit strange, but they will find few ideas about film per se that haven't been broached by other writers. What they will find, it is hoped, is an outline of the structure of filmic communication and its functions stripped bare of aesthetic evaluative components placing into sharper focus the issues which stand between us and a greater understanding.

The assumption here is that the film aesthetics literature constitutes an informed first approximation to a description of filmic communication. These materials can be considered as the results from a self-selected panel of judges who have been willing to publish their introspections. There will be some idiosyncratic responses in such self-selected introspection; there will also be common themes and conflicts between approaches. As a body this literature is believed to serve as a better first approximation than any single individual's introspection.

No attempt will be made to conform this description of filmic communication with any particular psychological theory. The use of some of the terminology is not intended as statements of the nature of the psychological processes. Where necessary, the existence of certain processes will be postulated as minimum requirements for explaining what appears to happen in filmic communication. Precisely how it happens in terms of psychological mechanisms will have to be examined by other, more qualified, investigators.

One further caveat should be entered. This study views as invalid the widely accepted dichotomy between "educational films" and other types of films.[1] This dichotomy is seen as being valid only under extremely limited conditions. Generally it is assumed here that communication through film may differ in detail depending upon the objective but that film qua film has general characteristics that can only be understood by reference to the whole range of available examples. It is clear that linquistics would be a much impoverished field if it attempted to restrict its study to, say, language as used in the classroom or to language as used on the stage; or what is probably closer to the case in the study of filmic communication,had two sets of otherwise capable scholars, each studying one of the fields with little or no cross-reference.

---

[1] This dichotomy is accepted by both writers on "film art" and the writers on "instructional media." See Kracauer (1960) and Munsterberg (1916) for the former and Travers (1964) and Lumsdaine (1963) for the latter.

The approach to be adopted is borrowed, in general, from linguistics and psycholinguistics. Modern linguistics attempts to describe the structure and function of language; based on these descriptions, psycholinguistics attempts to explicate the psychological correlates of language. In any complete description of filmic communication both approaches are required. But, as we have suggested earlier, premature attempts to explicate the psychological correlates of filmic communication have taught us more about verbal learning than about film. Just as linguistic descriptions are the fundaments of psycholinguistic manipulation, a description of filmic communication must be antecedent to scientific investigation of the psychology of film. (See, e.g., Fodor, Jenkins and Saporta, 1967 on the similar relationship between linguistics and psycholinguistics.)

The study of film through linguistic approaches should not be confused with an earlier idea of "the language of the film." The latter idea stretches back into the earliest writings on film, but appears to be largely metaphorical and, in any case, not terribly useful. One of the first full-length studies of film, by poet Vachel Lindsay (1915), posited the idea that film was similar to hieroglyphics with different shots representing different determinate meanings. A number of "definitions" in this language were offered. About a duck we are told that:

> In the motion pictures this bird, a somewhat z-shaped animal, suggests the finality of Arcadian peace. It is the last and fittest ornament of the mill-pond. Nothing very terrible can happen with a duck in the foreground. It would take Maeterlinck or Swedenborg to find the mystic meaning of a duck (p. 175).

The Russian director-theorist Eisenstein (1929) also used the hieroglyph to aid in his classic explication of film, seeing in hieroglyphics the conception of film editing. Each separate heiroglyph "corresponds to an object, to a fact, but their combination corresponds to a concept. From separate hieroglyphs has been fused — the ideogram. . . . But this is — montage!" (p. 30).

An intensive, if unsuccessful, attempt to delineate the structure of the film was published under the title A Grammar of the Film (Spottiswoode, 1935). As late as 1964, the metaphorical relationship between language and film seemed still to intrigue writers in the aesthetic tradition: "It is essential to establish the elementary characteristics of film language although we are not yet ready to deal with the vocabulary of this special language, nor with its grammar and structure" (Lawson, 1964, p. 175).

Whether film is a language is an almost metaphysical problem of no particular value; nor is there any special utility in adopting directly the categories of linguistics. The hazards of preexisting categories and theoretical preconceptions can plague the film scholar just as much as the learning theorist. There does seem to be some value, however, in using the linquistic paradigm in thinking about filmic communication as an organized mode of communication so long as one doesn't become a prisoner of his analogies. When the analogies begin to break down, as they do fairly quickly in language-filmic communication comparisons, then one must be prepared to follow the discrepancies rather than attempt to impose a conformation where none exists.

In recent years, a few writers attempted to make use of the contemporary insights of linguistics and psycholinguistics to examine filmic communication. One of Osgood's students, Gregory (1961) argued that language grammar and film editing technique could both be subsumed under common psychological principles. According to Gregory, meaning is signalled in such distributive languages as English and Chinese by changes in the sequencing of words rather than by changes in the words themselves as is true in inflectional grammars such as Russian.

In analogous fashion, Gregory argued, the major signalling systems of film are distributive and depend on the sequencing of scenes. Each scene as photographed was viewed as creating a set of meanings ("a thesaurus") from which the editor could choose meanings ("words") to include in the edited sequence. These combinations of meanings form assertions the mechanics of which could then be understood in terms of mediational synthesis (Heider, 1958) and the principle of congruity (Osgood, Suci, and Tannenbaum, 1957). "However, just any succession of scenes cannot be expected to make an assertion. The connection must be what Osgood calls associative" (Gregory, 1961, p. 40).

Writing about "film as non-art," Worth (1966) emphasized the inferential process between communicator and audience. "The meaning of a film is a relationship between the implication of the maker and the inference of the audience. . . . Meaning is clearly that which *we infer* from the film — from its elements, units and parts" (p. 323, italics original). Without making a commitment on the issue of whether film is a language, Worth (1968) suggested the study of visual communication *as if* it were a language. This study he called vidistics and would be concerned with the determination and codification of the visual elements used by the film maker and the "laws of 'language' by which a viewer infers meaning from cognitive representations and interactions of the elements and their sequence" (p. 132-133).

As did Gregory, Worth (1968) distinguished between the full shot as it came from the camera and the shot as used in the edited sequence. The former he called a cademe and the latter an edeme. The cademe can be thought of "as the storehouse of usable sounds available to any one speaker. . . . The edeme then becomes those specific sounds a speaker finally isolates to form words and combines to form sentences, paragraphs and larger units." The edemes are sequences "in ways that are determined by the individual filmmaker, his communicaton needs, his particular culture, and his knowledge of the 'language'" (p. 134). In addition to the image which is represented by the cademe and edeme, Worth suggested as analytic parameters, motion, time, space, and sequence with sound, color and other sensory stimuli as an overlay matrix.

A similar approach, using the paradigm of linguistics and psycholinguistics as a research strategy in studying film, was proposed by Pryluck and Snow (1967). Where the others had concentrated on the shot as the basic element, Pryluck and Snow emphasized what they called information channels, the classes of information transmitted within a film. In any film, they argued, there are two major classes of information which differ in terms of the kind of information they transmit. These general classes of digital and analogic information were further subdivided into a 2x3 matrix with audio/video and verbal/nonverbal/paraverbal as category headings. Each channel or class of channel, Pryluck and Snow suggested, "may have its own syntactic characteristics, and a detailed structural analysis of each may be necessary." (p.64). These analyses might be made directly by psycholinguistic techniques where applicable; other forms of analysis were suggested which were deemed to be applicable to the uniquely filmic information channels.

While all of the several previous accounts seem to be talking about film or visual communication, they do not seem to be all talking about the same thing. As presently organized, it is difficult to believe, for instance, both the transmission channel views and the film language views. If film is a transmission channel only, then clearly it has no unique "language"; if film does organize experience in unique ways, then it is not merely a transmission channel.

Even if this apparent paradox can be resolved by demonstrating that both views are correct for the aspect of the phenomenon they are studying, other problems remain. How can it be demonstrated that filmic communication does or does not organize experience in unique ways? What are the specific characteristics of filmic communication involved? How does filmic communication differ from language communication? Do the apparent differences between motion pictures and television "lie more in philosophy and practice of production than they do in inherent media differences" as Lumsdaine (1963, p. 588) has asserted or perhaps is the medium in some specifiable way part of the message?

III

SYMBOL SYSTEMS AND TRANSMISSION CHANNELS

Structure and function: As a preliminary to more detailed examination of some of these questions let us first sketch some of the more general relationships between variables that appear to be involved. A primary distinction can be made between structure and function. Structure pertains to the relationships among elements of the code, and between code elements and the environment; function pertains to the relationship between the code and its utilization in the communication process.

The Yin-Yang pinwheel of figure 1 attempts to illustrate two related propositions about the variables in educational communication: 1) that the structure of a symbol system mediates between the environment and cognition, and 2) that there are interaction relationships among the elements of structure, individual cognitive processes and the objectives of a communication. A central objective of the present study will be to integrate these propositions and variables into a single conceptual framework. It will be argued that the interaction of symbol system coding, cognitive processes, and instructional objective through a process termed coding transformation can account for the obtained and hypothesized effects of filmic communication in education, from the simplest to the most complex.

The structural characteristics of a communication system mediate the environment in particular ways which in turn constrain or facilitate the functional capacity of the system with respect to the cognitive processes of an individual receiver and the objectives of the communication. To take an extreme example, a verbal description of a spiral staircase is likely to be more approximate than a visual description. The relevance of the degree of approximation would vary depending on whether the receiver of the message was familiar with spirals in general and whether, e.g., he was being asked to build a spiral staircase.

The structural characteristics can be further distinguished between inherent structure and imposed structure. There seems to be an important distinction between those characteristics which are inherently part of the system, such as the depiction of movement, and those imposed characteristics, such as rhetorical questions, which could be common to several systems. A mediating relationship is hypothesized to exist between these two types of characteristics; certain forms of imposed characteristics derive more readily than others from given inherent

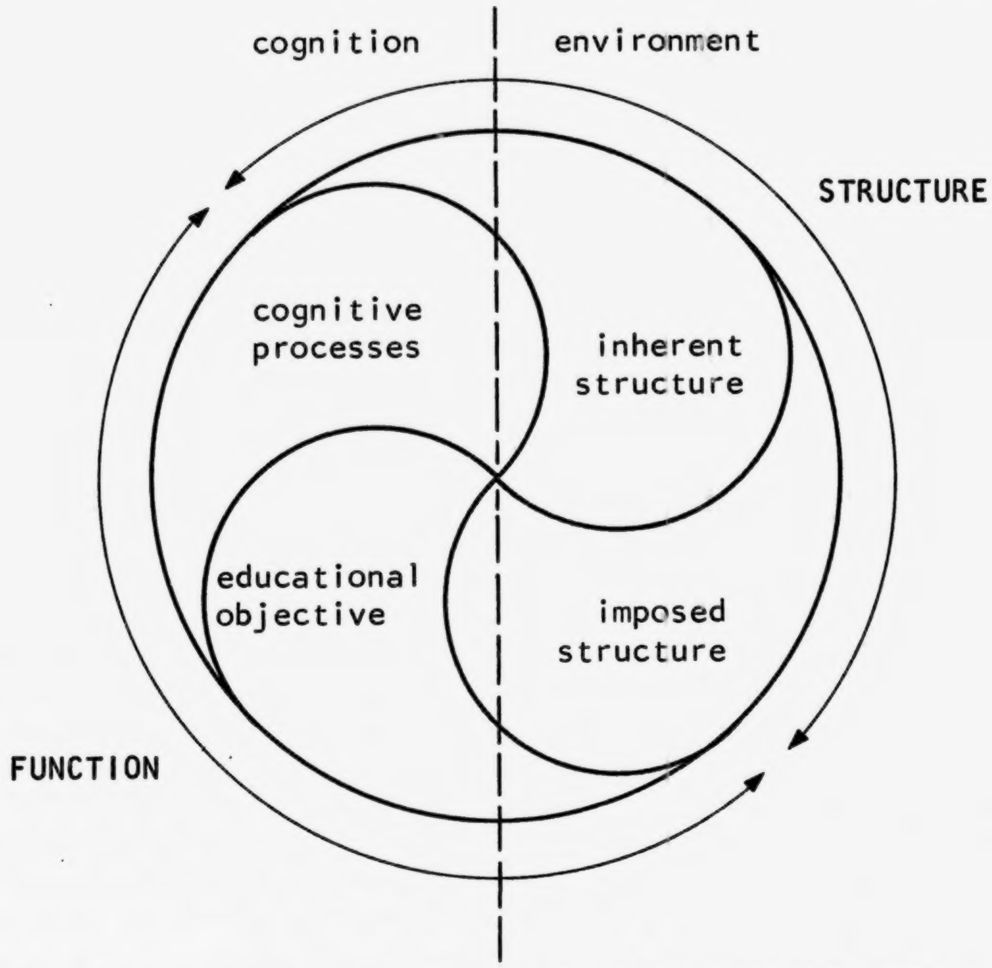
cognition
environment
STRUCTURE
cognitive processes
inherent structure
educational objective
imposed structure
FUNCTION

FIGURE 1: SCHEMATIC RELATIONSHIPS AMONG ELEMENTS OF A SYMBOL SYSTEM

characteristics, conversely, certain inherent characteristics facilitate certain imposed characteristics. For instance, drama is more readily presented in a symbol system whose inherent characteristics include speech and movement than in a symbol system whose inherent characteristics limit the rendition to words printed on paper.

In the following analysis the assumption is made that language and filmic communication are both systems of formal communication which have manipulable characteristics which can be compared and contrasted. No a priori judgment is made about the equivalence of language and film; any similarities or contrasts will be those which derive from comparative analysis of the two systems.

One way of making this comparison for inherent structure (and possibly imposed structure) is to examine in detail the ways in which experience is translated into a symbol system. Structural analysis of symbol systems becomes possible when it is realized that they are characteristically composed of some kind of units which can be manipulated through series of coding decisions to form other, successively larger, units which can be transmitted. We choose words to form sentences, which we organize into paragraphs that are organized into lectures, novels, technical manuals, poetic dramas, etc. Trained manipulators of symbol systems are not normally conscious of these coding decisions, but the neophyte is painfully aware and the investigator of symbol systems must make himself cognizant.

An approach to the task of comparative structural analysis can be borrowed from the descriptive linguists as they begin to describe any new (to them) language. They first accumulate all of the distinctions that they can discriminate, and only then evolve from the language as it is used a set of descriptive categories which are susceptible to some kind of test. This approach avoids the use of preexisting categories which can obscure the categorical discrepancies that exist between symbol systems. Even in a quest for synthesizing concepts an understanding of these differences is necessary, if only to know what factors are hindering a successful synthesis. Although they obviously work with hypotheses, modern descriptive linguists make as few a priori judgments as possible; all they know of a language is from analysis of the language itself and from what their informants tell them about the use of the language.

Within this framework, the fundamental assumption of our structural analysis is the same as that which appears to underlie linguistic analysis: each symbol system has a range of coding devices which differ along some dimension and that some differences make more difference than others. For each symbol system, then, the analytic questions must be 1) what are the coding devices, 2) how do the coding devices differ for various symbol systems and 3) what differences do make a difference? The last question is an empirical question and will be treated as such in this analysis. No attempt will be made to prejudge the case except in terms of the apparent existence of coding devices and the apparent differences between symbol systems.

Functional analysis focuses on the ways in which the inherent and imposed structure of a communication message constrains or facilitates cognitive processes relative to the information transmitted and the objectives sought. This is a more complex question than that posed by the capacity of a single structural characteristic. Language, as a consequence of its structure, can make certain kinds of assertions while film as a consequence of its structure can make certain kinds of assertions. The structural characteristics contribute to the differences between the ways in which different symbol systems make assertions about attributes; making some assertions more effectively and some others less effectively. In the ultimate case certain symbol systems cannot make certain assertions about certain attributes.

Multi-stage process model of codification: All of the foregoing comes to focus in a model of the codification process which attempts to highlight the nature of the classes of variables that must be considered in any account of filmic communication. The model is analytical in the sense that it is concerned less with how film communicates than with how we might find out how film communicates.[2] It is designed as an attempt to explicate the relationships between major components of filmic communication and the relationships which appear to obtain within these components.

The analytic orientation of this model, schematically depicted in figure 2, is that any symbol system draws from the environment selected data which are organized through series of coding decisions into a particular communication. The minimum unit — the primary coding unit — is organized into secondary coding units; the combinations of secondary units available to a symbol system, according to this view, define the symbol system. General symbol systems have only a theoretical existence *in vacuo*; their existence as viable communications depends on some physical channel of transmission.

Beyond the general symbol system and channel there are specific symbol systems which further define the shape of particular communications. Briefly, the general symbol system consists of the complete aggregate of inherent structural characteristics while a specific symbol system is a selected aggregate of structural characteristics, inherent and imposed, transmitted through a particular channel. Thus there are potentially a number of specific symbol systems subsumed under a single general symbol system.

The analytic orientation toward any particular symbol system can be traced through the model by following the succeeding arrows running through the symbol system of interest. This schematic is not intended as being definitive of any of the symbol systems seen as contributing to the construction of a film symbol system. For instance, writing and speech are different symbol systems but this is not the place to elaborate that argument. It is sufficient to note that the system contributing to film is speech not writing. Similarly, the nature of music as a symbol system in this representation is sketched only enough to indicate its relationship to film.

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[2] The last two chapters of this report will consider the problem of how filmic communication appears to operate.

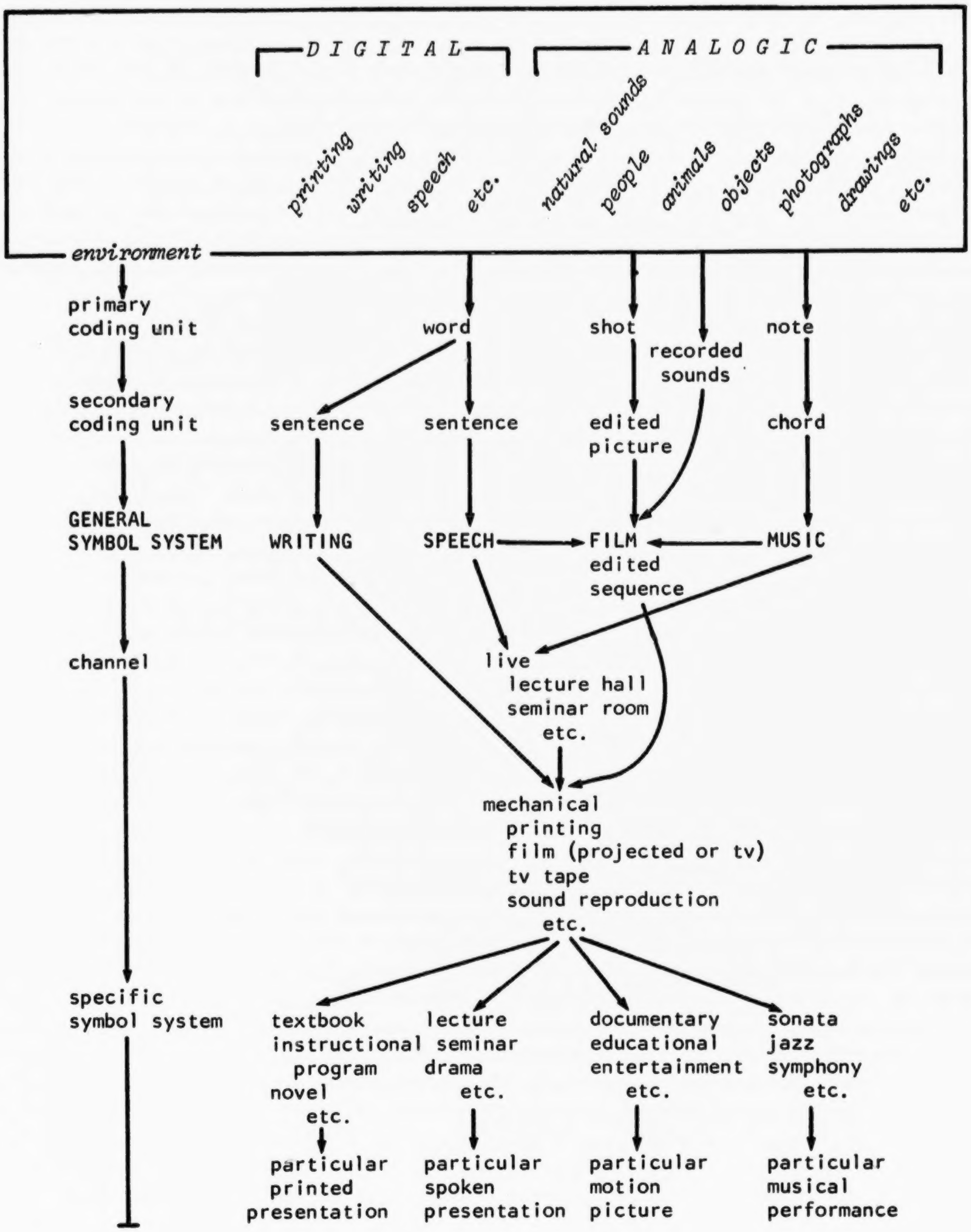
DIGITAL
ANALOGIC
printing
writing
speech
etc.
natural sounds
people
animals
objects
photographs
drawings
etc.
environment
primary coding unit
word
shot
recorded sounds
note
secondary coding unit
sentence
sentence
edited picture
chord
GENERAL SYMBOL SYSTEM
WRITING
SPEECH
FILM edited sequence
MUSIC
channel
live
lecture hall
seminar room
etc.
mechanical
printing
film (projected or tv)
tv tape
sound reproduction
etc.
specific symbol system
textbook
instructional program
novel
etc.
lecture
seminar
drama
etc.
documentary
educational
entertainment
etc.
sonata
jazz
symphony
etc.
particular printed presentation
particular spoken presentation
particular motion picture
particular musical performance

FIGURE 2: MULTI-STAGE PROCESS MODEL OF CODIFICATION

The structural characteristics of a symbol system may be either inherent or imposed and are manifested in either coding or transmission, i.e., their effect is either selective or general across a communication. Inherent characteristics are those characteristics which define the system; imposed characteristics are those forms of organization of which the system is capable. In general while both types constrain or facilitate the restructuring of the environment, the inherent characteristics define what apparently can be done with a symbol system and imposed characteristics demonstrate what has been done.

For example, any message can be transmitted via telegraphy; the final product will be all in capital letters and at one time the punctuation would have been written out. The absence of lower case letters and the spelling out of punctuation are obvious inherent limitations on the channel, and the fact that punctuation is no longer written out illustrates that constraints are not necessarily immutable. However, there are no inherent constraints on coding; the coding selections can be made and the message transmitted with no further selective change.

The fact that telegraph messages are customarily charged by the word is an imposed constraint on coding that facilitates a unique linguistic form, "telegraphese," influencing syntactic structure and lexical choice. There is also for telegraphy an imposed channel constraint. Most people are not accustomed to receiving telegrams; a fact reflected in the folk tradition that a telegram means bad news. This imposed constraint limits the circumstances in which one might use a telegram for communication.

Our analysis can start from the simple idea that there are numerous types of information in the environment. Some of this information we experience through our psychomotor involvement; we walk on a sidewalk or across a lawn; we ride a train or a horse; we are hit by a ball carelessly thrown by children. Other information we experience as continuous sensory inputs; we see and smell flowers; we watch a squirrel dart across the street; absorbed by the sight, we neglect to look both ways as we approach a street corner and leap backwards at the sound of an approaching vehicle. Still other information we experience as symbols: we hear our companion on this imaginary walk suggest that we stop for a soft drink that we have just seen advertised on a billboard, or at home, a roofing salesman shows us a price list and explains the cost per square foot.

In the environment we can distinguish two general classes of information: digital and analogic.[3] Digital information consists of systems of arbitrary symbols: the alphabet, numbers, etc. In general, digital information is serial and discrete; its structural units are clearly delimited and defined. The units in digital information are usually socially agreed upon arbitrary units which can be manipulated according to established rules.

The second class of environmental information, analogic, is the class of information generally classified as nonverbal. The color, the shape, the movement, the natural sounds, etc. of objects in the environment are all analogic information. It is simultaneous and continuous; there are no standard units except for the object itself. Analogic information consists of two sub-classes: one drawn directly from the environment by the cognitive processes of the recipient individual, e. g., the books and papers on my desk, my wife moving around the room as I type, the sound of children on the street; the second analogic subclass consists of mediated information, e.g., the pictures on the walls, the sequenced pictures of a film. This distinction will become important in subsequent discussions of the functions of mediated information.

No matter what the environment, these types of information impinge on our consciousness: at home, in the street, in the classroom -- everywhere, we are bombarded by these varied types of data and information. Fortunately a selection process of some sort is continually operating. A pair of lovers out for a stroll are not so likely to notice the squirrel or the soft drink ad; if they did notice the squirrel, their delayed recall of it would probably be in quite different terms than would the recall of a young city boy or a mammalogist specializing in squirrels.

Another way of speaking of the selection process is to say that we code those aspects of the environment that are most significant to us. Coding can be defined as selectively structuring the environmental data in such a way as to make it more easily usable, either immediately or at some future time. As defined, coding may refer to either internal or external processes, i.e., to cognitive processes or symbol systems. In either case, the definition is consciously looser than those used by some writers; e.g., Sebeok (1962) defines coding as "an operation, governed by strict and logical rules, aimed at gaining increased efficiency by having elementary signals organized into patterns of alternative actions" (p. 431, italics added). The looser definition is adopted to avoid prejudging the question of rules and their strictness which seems to be one of the points at issue in consideration of filmic communication.

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[3] The terms analogic and digital as used here are of course borrowed from Ruesch and Kees (1956). The terms are seen as describing stimulus characteristics whether the stimuli are raw experience or experience mediated by a symbol system.

Symbol systems and transmission channels: Film has been often viewed as a mechanical extension analogous to printing. There are important differences which weaken the analogy. When writing is reduced to the printed form, there is no way in which the coding is selectively influenced by the procedure. The printer may print four point type in light green ink on dark green paper or he may use a highly legible type set with tasteful margins. Whatever the typographic design, the effect is general across the communication. What is written remains substantially in the same code but in a more convenient and sometimes neater form. It is useful to describe writing as a symbol system and printing as a channel, using the criterion of selectivity to distinguish between coding and transmission.

Coding is a process of selection. The choice of some coding option may not influence coding while other options may be crucial in coding. In spoken Spanish it doesn't make any difference if one sins or sings while in spoken English it makes an obvious difference.[4] It doesn't make any difference in spoken English if the accident happened b'kuz 'twas nite; in written English it may make a connotative difference and perhaps a denotative difference. Similarly in other symbol systems the selection of coding options may make a little, a lot, or no difference at all. The selection may affect connotation or denotation. These are not matters that can be settled a priori; given the dimensions of the coding or channel variables they become empirical problems.

The distinction between coding and transmission is less easily made in film than in some other symbol systems. Only under limited circumstances can there be transmission without coding; primarily when the camera is used as technical recording device, e.g., micro-photography or a photographic record of oscilloscope tracings. The controlling consideration is the degree of selection possible; where there is none, the camera is a transmission device. Under these circumstances, there is no way that the photographic process can selectively determine the outcome; the technical characteristics of lack of color, depth, etc. are channel limitations, general across the communication. Selection takes place, though, the moment a camera is pointed at most objects. There are for instance, an infinite number of angles from which to photograph an object; the choice of one of these angles to the exclusion of the others can sometimes be highly consequential in communicating semantic content. It is widely assumed in the aesthetic literature, for instance, that an angle shooting up at a person imparts a meaning of power to the image while an angle shooting down tends to emphasize the helplessness of the character. Whether these assumptions are valid is an empirical problem; the consequence of the effect in an instructional setting is yet another problem.

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[4] The phones /n/ and /ng/ are allophones in Spanish while they are phonemes in English.

Despite this confounding of the transmission and the coding function it is still useful to restrict the use of channel to describe the former, while symbol system would describe the coding function. Where there is no danger of confusion, symbol system can also be used to describe the unit encompassing both functions, e.g., film is a symbol system. This usage parallels the point that words as symbols can serve both signal and symbol functions (Langer, 1942). In an earlier effort in structural analysis (Pryluck and Snow, 1967), channel or information channel was used to describe what now can be called a coding sub-system. With this new terminology, speech, for instance, is a symbol system consisting of two coding sub-systems, one digital—the audio verbal—and the other analogic—the audio para-verbal.

Coding units — some definitions: Coding, as a selective process, consists of a series of coding decisions; the manifestations of these decisions are coding units, units of meaning which encompass content and expression. The relationship of these three terms are schematically represented in figure 3.

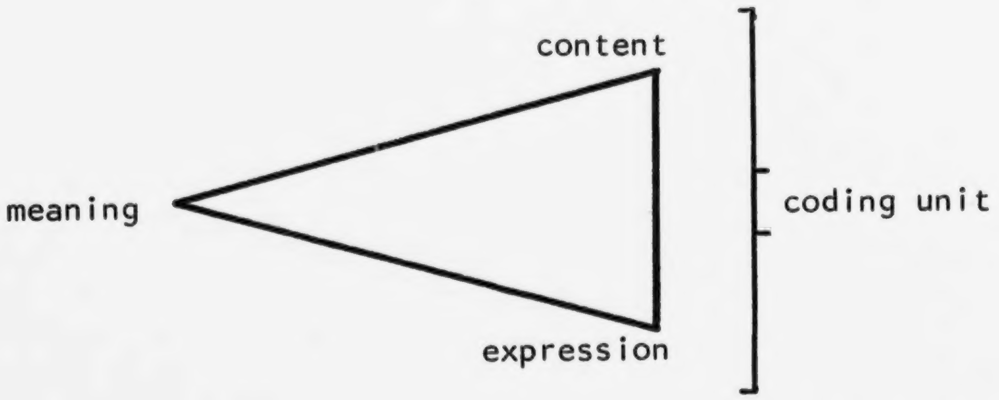

FIGURE 3: SCHEMATIC RELATIONSHIP BETWEEN MEANING, CONTENT, EXPRESSION

The environment which the coding process selectively structures can be seen as an aggregate of attributes (including conceptual objects and attributes, e.g., God, liberty). The hypothetical complete and unconstrained aggregate of attributes of an environment can be spoken of as the content of that environment. In a communication, selected sets of attributes, and assertions about them, are represented by expression, i.e., the arrangements of symbol system elements (adapted from Gleason, 1961). The specific shape of the expression summarizes not only the set of attributes referred to, but also the communicator's assertions about them. As viewed here, the coding elements of the symbol system (expression) and the attributes in the environment referred to by expression (content) are related in determinate ways and are represented by the coding unit. When so represented, the collection of attributes and assertions may be referred to as the *semantic content* of a communication, while the phrase *manifest content* can be used when referring specifically to the attributes or the environment which these attributes comprise. *Meaning* will be viewed as the hypothetical complete and unconstrained distribution of associations and response potentials to the content and expressive elements of a coding unit. Associations are included as an approach to one operational definition following the word association paradigms; no other implication is intended. All associations and response tendencies are deemed to be of theoretical relevance; the development of adequate techniques for describing complex nonverbal response tendencies and associations is, however, a research task that remains to be accomplished (adapted from Deese, 1965; Brown, 1958).

IV

GENERAL SYMBOL SYSTEMS

Primary coding: Linguistic analysis, by use of such terms as morphemic and syntactic, distinguishes levels of coding decision that enter into the manipulation of a symbol system. Direct borrowing of similar terms would imply a rigor which is not yet present in the analysis of filmic communication; it seems advisable to use more general terms, primary coding and secondary coding. The parallel implied between "word" and "shot" as primary coding units is only approximate; words are composed of discriminable coding variables--phones, stress, pitch, junctures--which combine to form coding units; shots are composed of discriminable coding variables which combine to form coding units.[5]

In the most general case, the shot is a mechanically processed set of pictures presented in series of indeterminate length; as a pictorial representation the semantic content of a shot is direct and specific: it is a picture of something. The word, by contrast, has generalized semantic content and arbitrary length. From these contrasting characteristics arise a number of divergences in the way in which each may be utilized and analyzed.

The word chair subsumes a limited number of criterial attributes; a chair spoken about is a generalized four-legged seat with a back. The chair photographed is a specific chair with a larger number of attributes. It is an old rickety wooden kitchen chair, it is a plush easy chair, it is perhaps a carefully repaired not-so-rickety wooden kitchen chair. More, the specific chair is photographed from a specific angle, with specific lighting, occupies a certain space in the photographic frame, etc. Denotation and connotation, manifest content and semantic content are all but inextricably intermixed in the single representation of the photographed chair.

One way to view this characteristic is as the reductio ad absurdum of the numerous detailed significations for certain items in various cultures: parrots in Brazilian, camels in Arabic, snow in Eskimo. It is in this general sense that it is true that the cameraman creates a new vocabulary each time. This apparent one-to-one relationship between attributes in the environment and their representation on film seems to have led many writers to describe filmic communication in terms more appropriate to channels than to symbol systems (e.g., Knowlton, 1964; Lumsdaine, 1963). These writers are correct when they suggest the difficulty of discussing visual communication apart from the message; they go awry, I think, when they fail to recognize the difficulty of discussing the content of a visual communication apart from its expression.

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[5] The existence of something like filmic coding variables was evident to most writers on film who referred to them in different ways; e.g., form language (Belazs, 1953); formative media (Arnheim, 1933); differentiating factors (Spottiswoode, 1935).

As a consequence of the direct and specific reference of a pictorial representation, the expressive and content aspects of a filmic communication are inherently interrelated. Meaning as defined is drawn from both aspects in a way that is not true of language. The expressive aspects of language are by definition arbitrary. With the questionable exception of onomatopoeia, expression bears only an arbitrary relationship to content. Only the content signified elicits associations to the sound combinations represented by the orthography: pferd, cheval, horse. There is nothing in these sound combinations to suggest a large, solid-hoofed herbivorous mammal.

The expressive representations of pictorial communication are not arbitrary and they do appear to have associations independent of the content. A low key photograph of anything appears to have different meaning from a high key photograph of the same thing.[6] Whether the associations do in fact differ is an empirical problem. A number of similar coding variables have been cited in the aesthetic literature as having filmic communication consequences quite apart from the content: angle of view; size of image; placement of image in the frame; relation of images within the frame; lighting (angle, key, etc.); movement within the frame and camera movement; perspective.

It seems to be the case that content cannot be represented without an implication of expressive meaning; it also seems to be the case, in motion pictures at any rate, that there can be no expression without an implication of content. Even geometric shapes when animated were uniformly perceived by subjects to have anthropomorphic content (Heider and Simmel, 1944). This apparently inextricable relationship of expression and content in filmic communication points to a hazard in attempting to utilize linguistic paradigms for filmic analysis.

One important type of linguistic analysis proceeds under conditions of abstraction of expression from content. A great deal of the linguist's effort is directed to this type of analysis: the identification of patterns of sounds which signal content. The phonemic significance of the coding variables of a word can be analyzed abstracted from content. It is possible to describe as a fact the information that

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[6] Key in photography refers to the range of tones in the photograph; a low key refers to "pictures in which the majority of tones lie toward the darker end of the scale" while in high key "the emphasis is distinctly on the lighter tones" (Journal of the University Film Producers Association, 1960, pp. 20, 27).

/n/ and /ng/ are allophones in Spanish and phonemes in English, independent of the content to which this data might be applied. That this fact leads to amusing confusion in specific instances is illustrative, not substantive.

The confounding of expression and content raises as a general problem their independent analysis in filmic communication. The meaning of the content of a shot appears to inhere, at least in part, in its expression; the phonemic ranges of expression in a shot appears to inhere, at least in part, in its content. Whether a particular angle, for instance, is semantically different from other angles could depend in part on the subject being photographed. The general statement that the photographic angle has coding relevance can be made; but the phonemic range of angles must, it seems, be stated in the context of the content of the shot. While the linguist can make statement of phonemic significance conditional upon structural relationships within the symbol system, the filmic analyst must, it would appear, make statements which are conditional not only on structural relationships, but also conditional upon expressive-content relationships.

If this is the case, then caution must be taken in borrowing linguistic paradigms for design of studies in filmic communication and interpreting their results; straight adaptation could easily result in misleading conclusions. The above analysis leads to the suspicion that, contrary to linguistic practice, statements about primary coding in filmic communication will have to be made in the form: "Given coding variables have specified relationships for certain classes of content."

The little empirical work that has been done on the effect of the primary coding variables in filmic communication lend support to this position. The results of these studies suggest that the aesthetic intuitions were correct in general as they often are but that the particulars are more complicated than would be apparent from either aesthetic literature or a simple translation of linguistic paradigms (see Shoemaker, 1964; Tannenbaum and Fosdick, 1960).

The indeterminate length of the shot is another source of divergence between linguistic and filmic analysis. Worth (1968) attempted to deal with this problem by distinguishing between the shot as it comes from the camera, the cademe, and the shot as it is used in the edited version, the edeme. This is a useful distinction but even thus defined the shot is problematic as a basic unit. The length of an edeme can vary greatly with consequent variation in the amount of information transmitted. Edemes can range from fractions of a second showing a static close-up to several minutes of intricate camera movement showing complex movement within the frame. One way of viewing the edeme would be as a rough analogue to the linguistic utterance.

The concept of the utterance in linguistics enables analysis "to start with some unit of talk that could be marked off with no uncertainty" (Fries, 1952, p. 23). Similarly, the shot is a unit that can be marked off with no uncertainty; the shot, by definition, extends from one splice to the next. The concept of the utterance applied to filmic analysis could thus encompass shots of differing lengths and complexity yet still keep open the question of potential sub-units: space-bound coding variables such as the angle, and time-bound coding variables such as changes within a shot.

However, the use of utterance in this context must be qualified; to obviate any confusion, it is probably useful to use the term filmic utterance where necessary. In linguistic analysis the utterance approximates a sentence or a number of sentences, where the sentence is a group of words joined together by grammatical agreements and not grammatically dependent upon any other group. The shot, by contrast, is a single unit potentially encompassing the content of a linguistic utterance; the shot is more than a word, yet by its unity less than a sentence.[7]

Secondary coding: As with the comparison of words and shots, any comparison of the edited picture with the sentence is only approximate. Once the cademe has been encoded, i.e., mechanically processed using the coding variables available, it becomes the raw material for the construction of the filmic communication proper, just as words are the raw material for secondary coding in language. "The foundation of film art is editing" (Pudovkin, 1928, p. 23). This proposition by one of the Russian filmmaker-theorists of the late silent film period has since been echoed and accepted as a fundamental assumption of film aesthetics (with some modification proposed in Bazin, 1957). Scientific attempts to deal with filmic communication have not reflected the importance generally attributed to editing. Secondary coding is important in any symbol system since combining of primary units in some kind of arrangement extends the coding potential to almost infinite range. These extensions appear to have different consequences in languages and film. Structurally, the abstraction of a word tends to be specified by syntax and the specificity of a shot tends to be generalized by juxtaposition in editing.[8] The functional consequence of this elaboration seems to differ among symbol systems; sequencing in language appears to facilitate subtle distinctions in conceptualization while in filmic communication sequencing appears to facilitate conceptualization derived from the experiential nature of shots. In this sense, film would seem to be structurally inductive, while language would appear to be structurally deductive.

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[7] This comparison is valid for the languages familiar to most readers. There are some languages which have characteristics similar to those of a shot; the "words" in these polysynthetic languages are in effect "sentences" although they consist of a single unit (Hughes, 1962).

[8] I am indebted to Edward P. McCoy of Michigan State University for clarifying this point.

These differences appear to stem from the structural characteristics of sequencing. Whereas linguistic coding units "do not just get strung out one after the other in any order whatsoever," "any two pieces of a film stuck together inevitably combine to create a new concept, a new quality born of the juxtaposition" (Carroll, 1964, p. 19; Eisenstein, 1939, p. 63).

It is difficult to know whether these contrasting orientations toward sequencing in the two symbol systems are due to fundamental differences between them or are only apparent differences because of greater sophistication of syntactic analysis. In any event, it has been demonstrated that in language:

1 - Certain classes of words must occupy certain specifiable positions when signalling certain types of content, e.g., the declarative sentence *John is going* contrasts with the interrogative *Is John going* only by the position of a single word. Of the four other logical arrangements of these three words, only one, *Going is John* has any grammatical standing and then only in quasi-poetic use. Immediately recognized as being umgrammatical and perhaps contentless are the other three combinations: *Going John is*, *Is going John*, *John going is.*

2 - There are structure words whose definition (i.e., content) can be stated only with difficulty, and then not very satisfactorily. The function of these words is to relate content of other words in the context of a sentence. Although there may be disagreement in detail they are generally believed to have no inherent content; these words include such copulas as; *is*, *the*, *a*, *of*, *that*, *which*.

3 - Suprasegmental phonemes serve to establish semantic boundaries between consecutive sequences and within sequences. There is only a suprasegmental difference (signalled by punctuation) between *Radio commentators, who are often criticized, help mold opinion* and *Radio commentators who are often criticized help mold opinion*. There is no punctuation to distinguish between *girl hunters*, i.e., females who hunt, and *girl hunters*, i.e., those who hunt girls.

The linguistic characteristics of fixed word order, copulas, and suprasegmental phonemes seem to function as signalling devices for specifying relationships. The determinate sequencing of word forms can be seen as specifying semantic relationships quite apart from their content. Almost any speaker of the language understands in general who did what to whom and where when told something like *'Twas brillig and the slithy toves did gyre and gimble in the wabe*. Even when filled with nonsense syllables the structure of a sentence specifies certain relationships. The indeterminate order of shots within a filmic sequence, though, leaves open the nature of the relationships between shots.

Specifying relationships is the whole function of the copulas; they represent concepts of relationship and thus there are no obvious ways of independently expressing them by pictorial representation. A copula-like expression may be sometimes possible as part of the content of a shot; this is problematic.

The necessity of suprasegmental marking of semantic boundaries in language is illustrated by syntactic ambiguity as in They are cooking apples or the Sunday school pun, Gladly the cross-eyed bear. Possibly greater significance is indicated by discussions of the evidence relating to the written equivalent of the suprasegmental phonemes; it has been suggested "that the period and other grammatical features act as a kind of psychological barrier, which reduces the likelihood that temporally continguous terms, on opposite sides of this barrier, become associated with.each other" (Rothkopf, 1965, pp. 196-197; see also Osgood, Suci, and Tannenbaum, 1957, pp. 200ff).

None of these characteristics is present in quite the same way in filmic communication. There is no known limitation on the placement within a sequence of any particular class of shot. There is no way similar to copulas to signal the nature of the relationship between shots; there is no filmic equivalent to is, of, the, a, that, which, etc. There is no direct equivalent to the suprasegmental phoneme in filmic communication.

The direct reference characteristic of pictorial representation seems to preclude syntactic ambiguity; when necessary, marking of semantic boundaries in film is accomplished by matching or contrasting coding variables or content of the shot. More general application of these editing relationships will be discussed below.

Some attempt has been made to put the copulative and suprasegmental burden on the flimsy devices of optical effects; fades, dissolves, and wipes, etc. Whatever else these devices accomplish (and this is unclear) it is clear that they are not the equivalent of punctuation or any other grammatical characteristic. Their failure in this regard has been empirically demonstrated by Mercer (1952).

Contrasting with linguistic practice to an even greater degree, there are no clearly established rules, traditions, or conventions governing the placement of shots within a sequence; any number of shots could be sequenced in any fashion to the limit of logical possibilities. However, relationships in film are not completely indeterminate. Rather than being either determinate or indeterminate, filmic sequencing rules appear to be probability rules where all sequences have a $P > 0$; as such, they share certain qualities with bookmaker's odds--they may shift tomorrow depending on the circumstances. At this moment, however, it seems that the filmic equivalent to any one of the logical arrangements of the three words, going, John, is, might be an acceptable sequencing decision in given circumstances although the sequence equivalent to something like John going is might have a probability of perhaps P = .01, while the equivalent to John is going might have a probability of perhaps P = .50. These hypothetical illustrations perhaps offer a clue to why a skilled film maker was able to comment: "I find it almost impossible at this point to construct a sequence of shots that an audience will say is ungrammatical" (Worth, 1966, p. 334).

In short, there appears to be a difference in logical structure between language and film which is reflected in the sequencing of primary coding units. One central difference in the two symbol systems would appear to be in the specification of content relationships between primary units. Numerous subtle relationships can be fixed and specified through the manipulation of just the linguistic characteristics so far discussed; the possibility of numberless explicit statements of relationship is, I suggest, one factor that makes language the profound instrument it is. The general absence of devices to signal relationships between shots has important consequences for the nature of filmic communication.

In film the relationship between succeeding shots is direct and imperative based on the immediacy of the juxtaposition between shots. When two pieces of film are stuck together (to use Eisenstein's phrase) they are separated only by a substantially invisible marker, the splice. There is direct and immediate contact between juxtaposed shots. No intervention of any sort occurs between the content of a sequence edited for maximal juxtapositional contact. Juxtaposition, it is widely believed, lies at the heart of filmic communication. Succeeding shots are seen as qualifying each other; each juxtaposition is assumed to facilitate meaning not obviously present in either element in the pair.

From the definition of meaning as a hypothetical distribution of associations and response tendencies it can be assumed that each shot has a wide range of such meaning elements with varying likelihoods of appearance. The juxtaposition effect would appear to depend on relationships between overlapping elements between shots. While the nature of the relationships is not directly at issue here, it is recognized that no detailed description of the process at the effects side of the communication model is possible without making some commitment as to the mechanisms underlying these relationships. Whichever of the explanatory concepts one adopts it must be assumed that there is no exact match between the distribution of elements of the juxtaposed shots; the overlap could be between any of the elements in the distribution and thus need not be obviously present in either unit in the juxtapositional pair. As a theoretical proposition the concept of overlapping elements does not necessarily imply that the elements are common to both shots. It may be that the associations are overlapping in the sense of being jointly related to yet another association.

Inferential relationships: While juxtapositional relationships are assumed in other symbol systems, they take on greater importance in filmic communication due to the structural constraint that the viewer of a film cannot be told what are the relationships between shots. The viewer can of course be told through the narration; but that is a different problem which we will come to. The experiences depicted and their juxtaposition may be direct and specific, but the conceptual relationships between shots are indirect and inferential. When a shot of a young man is followed by a shot of an old man these are very specific and direct significations; their relationship, however, must be inferred. These inferences are not often happenstance. If inferences are elicited, they are the result of coding decisions directed toward establishing inferential relationships through the sequencing of consecutive shots. Inferential relationships are not quite the same as implications. The manipulators of a code are not necessarily aware of the implications of their operations; inferential relationships, however, are actively sought in filmic coding. In this sense then it is possible to have implications in filmic communication that transcend the inferential relationships actively included.

The existence of inferential relationships is the underlying assumption of film editing and perhaps of all filmic communication although the mechanism governing filmic juxtapositions is only dimly and intuitively understood. The juxtaposition of a shot of a man and a shot of a child playing do not simply show us what a man looks like compared to a child (although this is often the way sequences are conceived in pedestrian films). There are relationships that can be manipulated. One of the relevant variables in this context is the length of time each of the shots is permitted to remain on the screen. Or the order of the shots can be interchanged. Whatever the manipulations different meanings are hypothesized.

To elaborate on this example a bit, let us include a shot of a bowl of soup and a shot of a woman in a coffin. If we pair the man's face with each of the other shots in separate trials, the assumption is that the man's face will be perceived as being happy, pensive, or sorrowful depending on which shot it was paired with (Pudovkin, 1932, pp. 166-171). This classic example of juxtapositional effect is based on content; the same point could be made for expression by photographing a two-player scene from four different angles or with four different image sizes, e.g., long-shot, two-shot, close-up of each player. If each shot is used once in a sequence the assumption of film editing is that different meaning results from the permutations of these four shots, or in general that each of the permutations of any set of shots can stimulate different meaning. Whether there would actually be four factorial different relationships is an empirical problem; it seems likely that the 24 variations would in fact cluster in some fashion. If further seems likely that an example based on content would yield a greater number of distinct relationships than would an example based purely on expression.

An approximation to the juxtaposition assumption has been tested in verbal concept formation using sets of ambiguously related words (Judson and Cofer, 1956); Gregory (1961) successfully made a somewhat more complex test of the general proposition.

The assumptions of juxtaposition effect and consequent inferential relationships are among the major factors limiting indeterminate sequencing in film editing. These assumptions are similar to the condition for cognitive interaction proposed by Osgood and his colleagues (1957) that signs must be brought into a particular evaluative relationship, an assertion. Eisenstein's observations notwithstanding (see p.25), it appears to be stretching matters somewhat to expect a determinate inference as a result of juxtaposing shots of the following items (casually selected from a dictionary): mizzen-mast, sulfate process, canary.[9] Whereas in the Osgood formulation logical, literary or linguistic relationships are assumed to form an assertion, it is believed in film theory that for effective juxtaposition succeeding shots should have both expressive and content relevance.

In the absence of copulas and similar relational devices which satisfy the conditions for a language assertion, film theory generally posits the requirement for some kind of expressive relationship between juxtaposed shots. To take a simple example, it is possible to juxtapose shots of a man and a barnyard animal, say a pig. The literary allusion is clear, but aesthetic theory would argue that the plain literary relationship is inadequate; there is an additional necessity of relating the shots in some visual fashion. The logic of this position is that film can strengthen some allusions by simultaneously encompassing related attributes that language cannot: the specificity of pictures in other cases can obscure the literary allusion by specifying what should perhaps be abstract.

If the shots were of man and animal chewing and approximately the same image size (e.g., both close-ups) the literary allusion could presumably be buttressed by the up-and-down movement of the jaws. To complicate the example a bit further, take just any shots of a man and a pig and juxtapose them with yet another shot of a machine of some sort. There are perhaps some kind of associations relating these three shots; but suppose instead that the set of visually related shots was used in conjunction with a shot of a machine with a similar up-and-down movement. It is suggested by this line of reasoning that a more determinate response would be evoked by the visual comparison of the masticating movement in the latter set of shots: man, animal, machine. Suppose further that the man is not just any man, but a specific type, a policeman, a soldier, an academic; there would be evoked by this latest set of shots yet other associations different from the first two.

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[9] I.e., the aftermost mast in a two or three masted vessel, a process for making wood pulp, and a small bird.

Visual content and image size comparisons or contrasts are not the only devices for inferential relationships. As in the special case of these relationships, semantic boundaries, any of the coding variables can be used, e.g., similar or contrasting image sizes may be juxtaposed or, similarity or contrast can be signified between succeeding shots by actions or settings within the shots. Across any given splice there are numerous juxtapositional possibilities arising from the several coding variables, degrees of contrast, types of content, etc. The only established limits on these combinations have been pragmatically derived aesthetic considerations; in the language of the trade, a sequence is acceptable if it works, i.e., seems to communicate with an audience. As these considerations change, there is a consequent change in the probability statement covering particular types of sequencing.

It had for a long time been believed that juxtaposed shots should vary along at least one of the coding variable dimensions to avoid jump cuts, i.e., changes in scene with only slight changes in coding variables (see Reisz, 1953, ch. 14). One of the soundest volumes on film aesthetics offers this injunction against the jump cut:

> If a figure we have seen on one scene appears in another scene without intermediary pictures, by simply cutting them to follow each other, the spectator will consciously or subconsciously wonder how it got there. Such primitive alignment is apt to strike us as clumsy, as bad technique. But if we dissolve. . . . (Belasz, 1953, p. 148).

Contemporary film editing techniques, popularized by Godard (1959) in A Bout de Souffle (Breathless), and widely seen on television, have demonstrated that the injunction against jump cuts was not the imperative formerly believed. When such cuts are believed to make a point they have been widely accepted in recent years. It is worth noting, however, that Eisenstein (1925) used something very close to jump cuts in the Odessa steps sequence in Battleship Potemkin, notably in the juxtaposition of two substantially similar shots; a woman wearing pince-nex glasses, and the same woman with her glasses shattered (Eisenstein, 1929, pp. 55-56; plate 7, between pp. 52-53).

The jump cut and related developments of quick cutting pace is a modernization of the montage theories of Eisenstein and Pudovkin; a second trend arising from the theories of Bazin (1957) has emphasized an integrated shot, the long take. The long take is seen as imparting a spatial unity and a consequent reality: what appears on the screen must be true since we see it in actual, rather than editing, juxtaposition. Whether there is validity to this position is an empirical problem; if it is a valid position, the coding problem merely reverts to the level of primary coding. This critical debate is yet another example of the difficulty of conceptualizing film simply in aesthetic terms -- this is good, that is bad. A film will soon be made that is intuitively good and theoretically bad. It is further worth noting that the long take harkens back to the earliest days of movie making.

Sound/picture interaction: These matters become thoroughly confounded with the inclusion of sound accompaniment. Thus far our discussion of filmic communication has centered on the structural characteristics of pictures on the commonsense basis that without them there can be no motion pictures. However, it is a sometimes-forgotten historical fact that motion pictures have almost never been displayed without some kind of sound and verbal accompaniment. So intermixed have these components been that out-of-tune pianos tinkling something like the William Tell overture and sub-title cards like, "Meanwhile back at the ranch" have become cliches even for those whose first movie-going experience was a Rock Hudson film. Crude sound effects were also part of the display; it was a poor theater that didn't possess a siren, a klaxon, a set of bells, etc. The significant innovation of sound films was not the inclusion of sound and verbal interpretation but their inclusion in precise and determinate fashion.

Before going further it is important to understand something of the mechanics of film production; in the most general case of filmic communication, motion pictures, the components are normally manipulated independently in four separate tracks;[10] a picture (or action) track, a speech (or narration, or dialogue) track, a music track, and a sound effects track. These are the phrases used in the trade to describe them and they have a literal independent existence in the formative stages of film making. Only at the end of the process are these independent components transferred into a channel form; the separate tracks are incorporated into a composite print which is the print customarily projected for public viewing. As a practical matter, the separate tracks are not always edited simultaneously, but, even when a single track is on the editor's bench, its relationships to the other tracks are considered.

At every stage of the formative process, these separate tracks are coded with continual reference to both the horizontal and vertical relationships schematically depicted in figure 4. The picture editing problem and the sound-music-word-picture problem are both contextual problems dealing with the interaction of effects in a context. It may be convenient to distinguish these relationships, referring to serial juxtapositions, relationships with a track, and lateral juxtapositions, relationships between tracks.

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[10] There are special cases (lectures, panels, news reporting, etc.) where this is not always true.

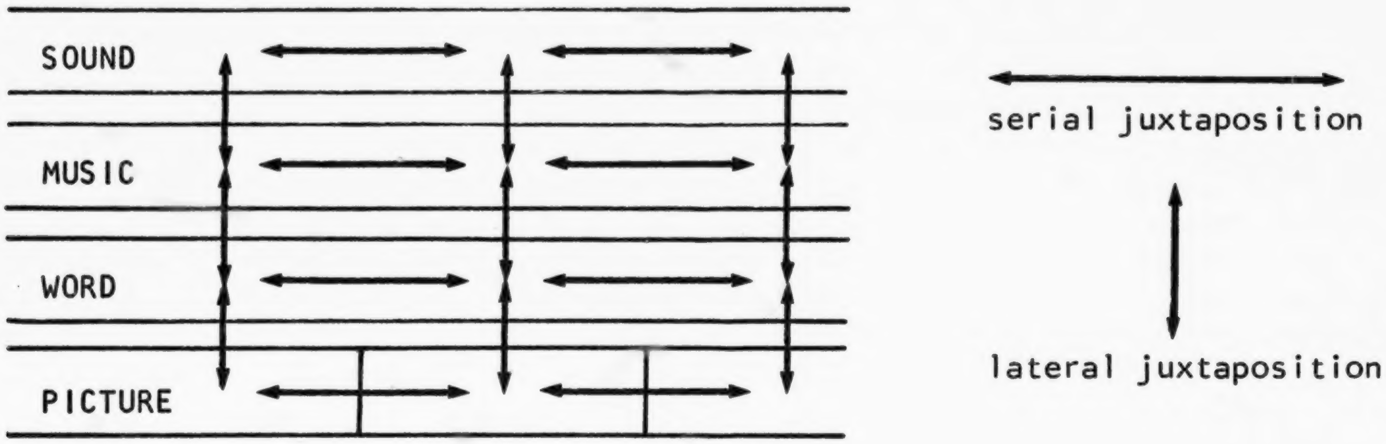

FIGURE 4: SCHEMATIC ILLUSTRATION OF SOUND-MUSIC-WORD-PICTURE INTERACTION

Understanding of the effects of individual components is only a start, a baseline. The fundamental problem of filmic communication is the interaction of these individual effects, serially and laterally. The simplest case of lateral juxtaposition is the precoded experience capable of being independently transmitted as other than filmic communication, e.g., filmed or televised lecture, demonstration, or panel. While this type of precoded experience is subject to minimum cross-track manipulation, there is, nonetheless, a lateral juxtaposition between the sound and the picture; the picture, at any rate, is subject to the specific constraints of primary and secondary coding. These constraints on the picture, it is suggested, might affect the meaning of the precoded experience and the whole unit (picture and sound) is subject to the general constraints of transmission which may further affect the meaning.

The emphasis in the original coding may not be congruent with the emphasis that is assumed to result from changing image size or changing angle; the pacing of the editing may differ from the pacing of the pre-coded experience; a general "dullness" may be introduced if an attempt is made to avoid varying image size or angle; (this is in addition to the similar effect suggested below in the discussion of transmission). Even in the event that the pacing and emphasis appear to be congruent between the experience and the filmic coding the work on combinatory principles governing different types of information simultaneously presented suggests that this apparent redundency may result in over-or under-emphasis (see e.g.,Manis, Gleason and Dawes, 1966;Kerrick, 1959).

There are further theoretical considerations regarding the apparent redundancy between word and picture. It can be argued that some words signify certain selected attributes while the related picture signifies a larger number of attributes. In this case the distribution of associations may be more extensive for the picture than for the word. The converse also appears to be true; some words signify greater content than do the pictures relating to these words. Strictly speaking, in neither case would the meaning of word and picture be redundant.

There are a number of lateral relationships; they will be defined in terms of a single sound track although there are similar combinations possible among the several sound tracks; the music track may have one relationship to the picture while the speech track may have another. Kracauer (1960) distinguished between the physical relationship (synchronous-asynchronous) and the communication intent (parallelism-counterpoint). In the terminology we are using we can make the distinction between semantic content and meaning, where semantic content is the collection of attributes and assertions represented by a coding unit and meaning is the hypothetical complete and unconstrained distribution of associations and response potentials to a coding unit.

As suggested by Kracauer (1960) and adapted to our present terminology there are three sets of relationships in lateral juxtaposition:

> Synchronism is the case where the semantic content of picture track and sound track are identical, e.g., a picture of a dog barking accompanied by the sound of the dog barking.
> Asynchronous sound is the case where semantic content of the separate tracks are not identical, e.g., the picture of a burglar's reaction to the sound of the barking dog.
>
> Parallelism can be defined as a form of redundancy, i.e., the same meaning is intended in both picture and sound. However, the ways in which picture and word are clearly redundant must remain an open question.
> Counterpoint is the case where different meaning is intended with the consequent attempt to evoke different associations for picture and sound, e.g., the discrepancy between a speaker's words and his actions presented simultaneously.

> Actual sound is the case where the sound and picture are similar in content, they are drawn from the same aggregate of attributes.
> Commentative sound is where the picture and sound differ in content. The sound of a band in a scene depicting a parade would be an example of actual sound even though the sound and picture would be asynchronous. Band music in juxtaposition with some scene which does not include a band would be an example of commentative sound. The off-screen narrator is another common example of commentative sound.

From these interaction possibilities arise other possibilities, such as the temporal relationships between tracks, e.g., is a particular natural sound presented before, after, or simultaneously with a particular picture? What are the temporal relationships of the other tracks to each other and to the picture? There is relatively little empirical evidence on this point (e.g., Zuckerman, 1949), but experienced film editors believe that a shift in the relationships of even a few frames (approximately one-twelfth to one-sixth of a second) can make some difference in the effect.

Independent meaning: The intimate interrelationship of word, music, sound and picture has generated a fair amount of controversy; here as with picture editing, the interest of science has not reflected the intensity of aesthetic concern. The issues in this area are even more problematic than those discussed thus far. There is general agreement in the aesthetic literature about the nature (if not the value) of what we are calling primary and secondary coding, even if there is little firm evidence supporting this agreement. No such agreement exists regarding the general relationship between sound and picture.

About the only agreement that exists is that motion pictures are essentially visual and that controlled interaction between tracks is important. The details of this interaction are the subject of debate between two critical positions derived from an evaluative judgment about the importance of words in films. The nature of the argument can be summarized in a question that one way or another has dominated much of the discussion: "Does Shakespeare come off second-best in films?"

Most writers on the subject subscribe to some sort of "channel over-load" theory, i.e., that there is some limit to a viewer's channel capacity in simultaneously dealing with analogic and digital information and that an overload of one channel would interfere with reception in the other.[11] The arguments are not often placed specifically in these terms, and if they are, it is rare that the implication of the position is spelled out. The quasi-theory is used as a given with little recognition of its psychologically problematic aspects. It is used as a point of departure for subsequent aesthetic arguments.

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[11] To the extent that he deals with analogic information this appears to resemble Travers (1964).

Given the idea of something like channel over-load, the arguments seem to reduce to speculation regarding the amount of over-load that the channel can take. The dominant position in film literature argues that words are entirely subsidiary to the visual and that if words are used it is necessary to "reduce the weight and volume of the spoken word" (Kracauer, 1960, p. 106). "Sound film demands a style of weightless words" (Belazs, 1953, p. 229). There is no standard that I know of for the weight of words; there does appear to be some agreement in literary criticism that the weight of words relates in some way to the associations of the words, i.e., to their meaning.

Other writers criticize the run-of-the-projection-room film on precisely the grounds that its words are trivial. The proponents of this position argue that contrary to the commonly accepted view, film can effectively use a more poetic diction. "The screen does not necessarily dim or grow boring because someone speaks a brilliant succession of words" (Alpert, 1962, p. 242). "I feel intensely that poetry, verbal poetry, is an essential aspect of cinematic expression" (Lawson, 1964, p. 196).

The anti-word position is often generalized as a principle that we will call independent meaning. The aesthetic idea of independent meaning is that all sounds in film—words, natural sounds, music—must not possess meanings "which assert themselves independently of the flow of visuals" (Kracauer, 1960, p.220). Kracauer refers to this principle under the heading of detachable patterns of meaning; Panofsky's phrase for it is principle of coexpressibility: "In a film, that which we hear remains, for good or worse, inextricably fused with that which we see; the sound, articulate or not, cannot express any more than is expressed, at the same time, by visual movement" (1937, p. 21). Belazs (1953) expresses similar ideas as the law of impermeability. As stated, this principle doesn't move the argument forward very far, since proponents of the poetic diction position suggest that they agree in principle, differing in detail (see, e.g., Lawson, 1964).

One way of viewing a coding unit with independent meaning is as a form of fully precoded experience; we have already discussed the simplest lateral juxtaposition for such a unit. However, if the juxtaposition assumption makes any sense at all, we must presume that something else may happen when coding units with independent meaning are juxtaposed in some of the more complex lateral relationships.

From the critical definitions it can be seen that independent meaning is generally believed to be a characteristic of speech or music. Pictures may or may not have independent meaning, but they are the stuff of movies thus their independence is relatively less crucial. Most writers agree that the interpenetration of sound and picture is the theoretical ideal; short of the ideal, the injunction against sound with independent meaning is urged. The general line of argument suggests that the meaning of sound and picture are diluted when coding units with independent meaning are utilized.

A favorite example in this argument is Shakespearean drama. It is suggested that the richness of Shakespeare's language is distorted when accompanied by an equally opulent picture (Belazs, 1953; Kracauer, 1960). The argument turns strictly evaluative with regard to the alternative simplification of the visuals. The viewer is only distracted, argues one side, by being able to see the warts on Romeo's nose; the rebuttal is that "interpretations can be made more incisive through the use of the close-up" (Alpert, 1962, pp. 242-243).

The problems surrounding independent meaning are not always this clear cut. Independent meaning of a verbal coding unit may be intricate and sophisticated. Juxtaposing such a coding unit with a pictorial coding unit could over-simplify the meaning of the words by illustrative specification of a complex set of meanings. The converse also exists as a possibility; subtle and ineffable picture track may be oversimplified by sound with independent meaning. Both of these possibilities stem in part from the structural limitation of film noted earlier; there are no ways in film to indicate such comparative relationships as: _is_, _is like_, _is something like_.

In practice, the injunction against independent meaning is not total. Coding units with independent meaning are sometimes utilized precisely because their independent meaning enables assertions to be made through conflicts between associations to the picture and the independent meaning of the sound. Music is often used in this way. _The Stars and Stripes Forever_ march may be played in juxtaposition with pictures of a bedraggled boy scout troop returning from a series of misadventures. In the National Film Board of Canada film _Caroline_ (Perron, 1964) Christopher Marlowe's lines _Come live with me and be my love and we will all the treasures prove_ ... are juxtaposed with a plain close-up of a young working mother on her lunch hour. The use of independent meaning has been described as challenging the image, forcing the audience to resolve the challenge (Selby, 1967), a comment which can be interpreted as arguing for the maximum extension of inferential relationships in opposition to telling the audience as much as possible within the constraints of the symbol system.

It was suggested earlier that pictures are structurally inductive while words are structurally deductive. This idea can be elaborated to suggest that analogic information is inherently inductive while digital information can be utilized inductively or deductively. From the examples given in the aesthetic literature it can be suggested that weightless words are inductive, specific instances of an experience rather than generalized statements of that experience. The critical mandate for weightless words to juxtapose with picture and natural sound may reflect an intuitively perceived need for some kind of logical consistency. Still at issue, however, is whether there is a psychological requirement for consistency between simultaneous inductive and deductive presentations of analogic and digital information.

The idea of independent meaning is based on the assumption that the coding unit might be more elaborate than a single word or a single picture. A coding unit could be a phrase, a sentence, a shot, a sequence of shots, etc. A larger coding unit obviously confounds the empirical problem, yet independence and weightlessness do not seem to be qualities of the simplest possible unit. They are more likely qualities of a complex unit. While there may be nothing outstanding about the individual words used by Shakespeare, most critics agree that his language is only occasionally weightless. Analysis of individual words might not easily predict the associations of The slings and arrows of outrageous fortune. The meaning of the larger unit does ultimately derive from the meaning of its sub-units; how the latter contribute to the former remains a fundamental question.

It would seem that while coding units with diffuse meaning may be qualified by other units in a symbiotic fashion, coding units with independent meaning are more resistant to such qualification. Furthermore, it would appear that some meanings are sufficiently independent that any further qualification begins to distort meaning rather than rendering it more precise.

Distort is not used in any pejorative sense. The distinction between distortion and precision is intended to highlight two different types of coding consequence. Using a pencil as a metaphor, an increase in precision is seen as sharpening the point, while distortion is seen as dulling or breaking (i.e., changing) the point. Evaluative judgment of these consequences is not our concern here.

In short, coding units with independent meaning do not easily enter juxtapositional relationships. This seems particularly striking in cases where there are several dominant associations in a coding unit; the dominant associations appear to interact with each other but not with any externally introduced associations. It is not clear that analogic information could add anything to take arms against a sea of trouble ... bear the whips and scorns of time although lines with independent meaning can under certain circumstances be usefully placed in juxtaposition with other coding units. Even in these cases, however, there appears to be a distortion of meaning, if only the distortion represented by irony. By contrast, weightless words do not seem to be susceptible to distortion; they appear to be words with diffuse meaning whose meanings can be made precise by juxtapositional relationships.

Although the argument has been usually couched in aesthetic-artistic terms, the issue of independent meaning is central to any discussion of filmic communication. Picture and sound seem to qualify each other at least as much as succeeding words, succeeding pictures, or succeeding sounds. When the sounds are words or music whose meaning is not dependent on lateral juxtapositions, independent meaning can distort the meaning of the picture or be distorted by the picture; there appears to be further qualification introduced by transmission channels which will be discussed below.

In short, it cannot be assumed that words or music or pictures when juxtaposed retain their intended meanings. Even if one wished to ignore the relationship between tracks, the relationship exists; in any filmic coding a decision is made (explicitly or otherwise) on the relative utilization of each of the tracks. Placed another way, the existence of multiple tracks is a structural characteristic of the coding operation, similar to the structural characteristics of coding variables in primary coding or coding units in secondary coding. It is assumed in the aesthetic literature concerned with film and is suggested here for more general application that these structural characteristics in some determinate fashion constrain or facilitate the communication of an intended message whether the message is entertaining, persuasive, or instructional.

Film literacy: The editing rhythm and rhetorical development of films produced in India appear to be characteristically more deliberate than theatrical films produced in the United States, which in turn are more deliberate than United States television films. The differences between Asian films and United States films are, likely, cultural manifestations; if they are, comparative analyses of films and other aspects of the cultures should develop some understanding of the mechanisms underlying these differences.

In general, for films in the Western European tradition (including the United States) it is possible in the historical development of films as a symbol system to trace a distinct trend toward the truncation of irrelevant action. It can be suggested that this trend is part of a more general elaboration and differentiation of film as a symbol system. These developments have been traced elsewhere with the conclusion that films can be viewed as a continuously evolving system of conventions used by film makers and understood by audiences (Pryluck and Snow, 1967).

The ability of a viewer to understand a film has been termed film literacy on the basis of scattered evidence indicating that there is some special ability involved in learning from film (Hoban and vanOrmer, 1950). There is also considerable anecdotal evidence (largely from primitive cultures) that indicates that inexperienced film viewers understand films differently from experienced viewers. This evidence has been organized to suggest that film literacy develops through experience in stages from total non-comprehension to at least some minimum level of comprehension (Forsdale and Forsdale, 1966). Somewhat similar conclusions have been reached from experimental studies with European elementary school children (Mialaret, 1966).

It is axiomatic that the coding-decoding assumptions of communicator and receiver must be congruent. Most of the film literacy evidence deals with coding that is more sophisticated than the decoding skills of the audience warrant. The reverse exists as a possibility:

the communicator may underestimate the skills of the audience. It may or may not be true, as the aphorism has it, that if you speak baby-talk you end up sounding childish; it certainly seems true that for maximum intelligibility the communicator should use the coding conventions which the audience is accustomed to. Eighteenth century speech might be intelligible at some crude level, yet it is suggested that its strangeness could distract the audience from the message.

"Proper" or "conventional" usage in any symbol system may be more a matter of clarity than of propriety. Although it may be a more accurate transliteration, b'kuz 'twas nite appears to be more difficult to read and understand than because it was night. The latter phrase gains in clarity what it loses in verisimilitude from following the conventions of the symbol system of writing. Examples of this difficulty can be seen in many Southern novels; even for those readers familiar with the dialects, the transliteration can be difficult to read with a consequent distraction from the communication.

A similar difficulty may be suspected with filmic attempts at literal translation of experience. Perhaps the reason that we avoid viewing other people's home movies is that they lack clarity through failure to utilize the minimum conventions; they are abortive attempts at literal translation of experience. Viewers of some "educational" films may sometimes sense a similar failure to adequately translate the experience through slavish attempts at verisimilitude.

Semantic and syntactic changes are linguistic processes which occur over generations; similar changes in film seem to occur over decades with the consequence that the communicator could easily be coding with conventions that the audience perceives as antiquarian. The elaboration and differentiation of film as a symbol system has been traced in aesthetic histories (e.g., Knight, 1957; Jacobs, 1939); the nature and consequence of semantic and syntactic shift in films is still a matter of speculation. These considerations would suggest that, for the present at any rate, the analysis of existing films must be treated as timebound; the year of production might be a relevant variable.

Analyses which include films produced, say, twenty years apart could result in misleading conclusions due to the confounding effect of shifting conventions. This is not postulated as an inevitable consequence; the point is a general one. The Quiet One (Meyers,1948), for instance, still seems contemporary even to audiences some of whom weren't born when it was produced. Readers can doubtless supply similar examples. The elements that enable a film to be timeless in this sense are among the aspects of shifting coding convention that can be profitably investigated. Related to this general point is the problem of contemporaneously produced films that utilize "old-fashioned" coding.

Transmission channel characteristics: Projected motion pictures and broadcast television appear for all practical purposes to be interchangeable; anything that can be transmitted through one channel can be transmitted through the other. At a rudimentary level, this is true. Films can be televised by projecting them on the television film-chain; videotapes can be transferred onto 16mm film for projection.

The extent to which the two channels are in fact equivalent, however, can be questioned. The general issue is stated clearly as a critical insight resulting from a small debate between a television network and a daily newspaper television reviewer. Most reviewers, faced with deadlines, are shown previews of television shows in projection rooms under motion picture viewing conditions. At least once, this practice led a reviewer to publicly suggest that the content of a widely-touted television show as televised had been altered from the performance witnessed at the preview. Not so, replied the network, the films were exactly the same. However, the reviewer perceived a difference, and in print argued: "The unavoidable reduction in perspective to fit the TV receiving box is not illusory; it tends to give an altogether different shape to a show that can be logically accommodated on a larger screen" (Gould, 1966, p. 73).

A similar intuitive judgment is possible in the comparison of a lecture and a book. A lecture can be transcribed and printed while a book can be read from a podium to an audience. The exact ways in which these experiences differ will remain subject to speculation pending the accumulation of more evidence than is currently available; it seems, however, that they are different. Books aren't customarily read to an audience nor are lecture transcripts customarily printed without revision. It's an empirical question, but books and lectures appear to differ in terms of the words used, the sentence structures, and the organization of the material. In the terminology we have been using, the coding practices of the symbol systems transmitted through the two channels differ in terms of secondary and specific symbol system coding. These coding differences (if in fact they do exist) are, likely, consequences of different channel characteristics.

The two most important classes of filmic communication, projected motion pictures and television, differ in terms of a number of inherent and imposed characteristics. Motion pictures are customarily shown to relatively large groups, by projecting light through a film, over the head of the audience, onto a screen intermittently at a rate which produces a flicker of 48 or 72 per second under darkened viewing conditions where the most remote seat is normally a distance from the screen of six-to-eight times the screen width. Television is customarily shown to relatively small groups, with the light projected at the audience under relatively high ambient light viewing conditions where the most remote seat is often a distance from the screen of ten-to-twelve times the screen width. The flicker phenomenon in television is somewhat more complex than motion pictures due to the continuous scanning of the television image which in the United States consists of 525 lines, half of which alternately change 30 times a second. Given these technical and social differences in the transmission channels, it would be expected that there would be differences in the perceptual tasks imposed.

A number of studies, largely European, which suggest that such differences exist have been reported by Mialaret (1966). If this evidence is valid, the problem then becomes what is the relationship between the perceptual task imposed by a channel and the coding utilizing that channel. As a simple example of this relationship, consider that the differences between television and motion picture image resolution capacity promotes different viewing distances. As a consequence of the more remote viewing distance customary in television viewing, it has an apparently smaller screen. If this is the case, then coding for the two channels might have to differ, e.g., long shots will tend to be relatively lost on the television screen. There are thus a smaller range of coding variables available to television coding which raises the possibility that the phonemic range of coding variables in television might differ from the phonemic range of coding variables in other filmic coding.

A more complicated problem concerns the physical task of staring at the screens of the two different channels. As noted, the conditions of flicker and ambient light differ between television and projected motion pictures and these conditions differ in turn between mechanically mediated channels and live deliveries. Little is known of the neurophysiological effect of the task of attending to any of these channels, but it can be speculated that if the effects differ significantly the differences could impose different coding requirements. If, for instance, there is a difference in attention as a consequence of the neurophysiological effect, a greater attention factor in coding must be provided for in the channels which elicit greater inattention. It may be necessary for a lecture to have a different quality when transmitted via one of the mechanical channels than when delivered live in order to "punch-through" the mechanical intervention. The direction of this change in quality is an empirical question; either a more "dynamic" delivery or a more "intimate" delivery can be justified by speculation. What does seem clear is that not every lecturer is an adequate television lecturer just as not every teacher is an adequate lecturer of any kind.[12]

No useful purpose would be served by speculating on other apparent coding consequences of transmission channel differences; there are enough intuitively percieved differences and a small amount of evidence to suggest that such consequences are real and not merely apparent. Beyond this it becomes an empirical problem of specifying the dimensions of the perceptual tasks and then elaborating on the coding consequences.

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[12] The lecture is used here illustratively, not as a recommendation for instructional procudure.

V

SYSTEMS OF IMPLEMENTATION

Bruner (1964) has reminded us that man advanced by utilization of systems of implementation which enlarged our capacities to deal with the environment. If we wish to shorten a board, we can break it using our limbs directly, or we can whittle it with a knife, or we can use a hand- or power-saw. If we wish to go somewhere, we can walk, ride a bicycle, or drive a car. Systems of implementation have superior effectiveness in dealing with particular aspects of the environment although they lack the all-purpose effectiveness of the human machine.

The systems of implementation enable us to deal with the physical environment of extending our physical capacity or by adding a specialized technique that we may bring to bear on the environment. A bicycle enables us to make more efficient use of the movement of our feet; an internal combustion engine opens completely new possibilities of locomotion. The first models of radically new instruments often carry over anachronistic features. Early horseless carriages were made by buggy makers who designed the vehicle in accustomed styles including a whipsocket which in previous models was intended to hold the horsewhip.

In somewhat similar fashion, the systems of implementation that enlarge our capacity to conceptually manipulate our environment either extend our reach or change the ways in which we may reach; in the early stages, the design features of the newer instruments often include elements of "whipsocket design" by uncritically attempting to transfer the design features of the earlier models to the newer instruments. When we use filmic communication to transmit a lecture or a panel we are using it as an electronic megaphone; we are simply extending our reach while continuing the perhaps inappropriate design features of earlier instruments. Almost from the beginning, educational films were hailed as a "window on the world." There was a face validity about being able to "bring the world into the classroom." There was, and continues to be, little concern with the mediating characteristics of film. Many educational films still seem to be informed by the "window on the world" view without the realization that this particular window is made of distorting glass which shapes the view of the world, well or badly, depending upon the skill with which the images are chosen, framed, and sequenced.

Educational film with some exceptions continues to function as a simple transmission channel; film in education has most often been used mainly as illustration of some verbally presented point. The most obvious example of this utilization is the filmed lecture or demonstration. The continuing dominance of this philosophy can be seen in the recommendations (advanced as innovations) for filmed lectures and filmed demonstrations approved in such otherwise innovative statements as Taylor (1966) or The Panel on Educational Research and Development of the President's Science Advisory Committee (1964).

In the face of the structural complexities discussed earlier and lacking clear guidelines, there is, too often, in educational films a retreat into the simplest mode, verbal exposition. Interactions between sound and picture typically follow the most direct expository form. There are few inferential relationships between word and image or between succeeding images. The potential for visual inference is often overwhelmed by verbalization. Even when an educational film is not simply of a lecturer at a podium, it often takes the form of a lecture with words dominating. This dominance commonly takes two forms: adequate visuals superfluously commented upon or narration which has only marginal relevance to the visuals.

It is no wonder, then, that educational films are widely viewed as encouraging passivity (e.g., Bruner, 1966; Hilgard, 1963). However, film per se does nothing to encourage either participation or passivity; Bruner recognized this when he suggested in the earlier quote about Last Year at Marienbad (see above, p. 3) that some films for some reason can encourage participation. Simply stated, film is merely another system of implementation with the potential for assisting in the conceptual manipulation of the environment; whether it does so is a consequence of the way in which it is utilized.

Inherent and imposed structure: The discussion of lateral and serial juxtaposition and the related discussion of primary and secondary coding has tried to show that components of film can be manipulated in a number of relationships. The extent to which a film is successful in attaining an educational objective depends on these manipulations of the environment as they relate to an individual student's cognitive processes. The failure of a particular film is not inherent in the film medium but rather in the way in which it has been utilized. In other words, the manipulations are imposed on the inherent characteristics of film. For example, motion and camera movement are inherent structural characteristics, while rapid camera movement (swish pan, or rapid pan) is an imposed structural characteristic.

This distinction between inherent and imposed characteristics may be useful in understanding some of the previous utilization of film in research and practice. In general, inherent structure is the set of relationships between the elements of a general symbol system while imposed structure is the organization of these elements into a particular presentation, i.e., a viable communication or "message" in the usual sense. Between the general symbol system and the particular presentation, there is an intermediate analytic level, the specific symbol system, which consists of a coherent set of inherent characteristics organized for transmission through a specific channel. For example, writing is a general symbol system, a novel is a specific symbol system, Dostoyevsky's Crime and Punishment is a particular presentation. Figure 5 summarizes these relationships:

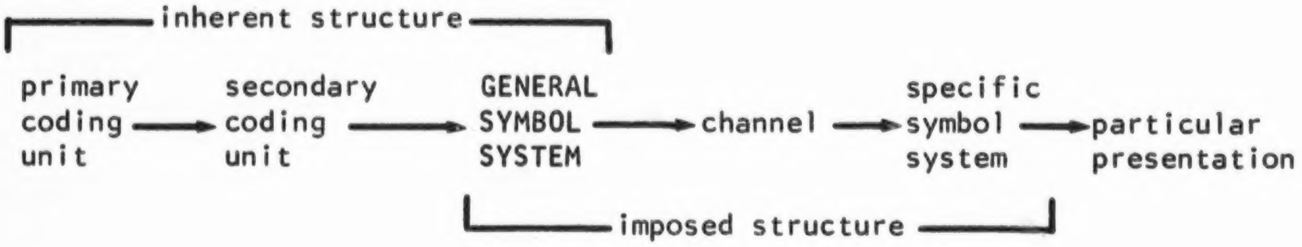
inherent structure
primary coding unit
secondary coding unit
GENERAL SYMBOL SYSTEM
channel
specific symbol system
particular presentation
imposed structure

FIGURE 5: SCHEMATIC DESCRIPTION OF THE ELEMENTS OF INHERENT AND IMPOSED STRUCTURE

The general symbol system derives from and is defined by its inherent characteristics, i.e., the characteristics of primary and secondary coding units. The combination of general symbol system and transmission channel shapes the particular presentation. A specific symbol system may be analytically defined by particular combinations of imposed characteristics. Thus poem and novel are analytic constructs; in practice, novels may be poetic and poems novelistic.

The same body of material can be adapted for other symbol systems, subject to the effects of differential codification. In making the adaptation, elements of the imposed structure of the original are retained, others are changed in response to the inherent structure of the newer general symbol system which constrains or facilitates the new imposed structure. A neat example of the operation of the process of differential codification is the work by Herman Wouk, The Caine Mutiny. The focus of the original Pulitzer Prize novel was the young ensign; the focus of the stage version was the court-martial; the focus of the film version was the shipboard action which culminated in the mutiny.

The essential elements of the imposed structure, the plot and the characters, were retained in all three versions. The varied focuses were a recognition of the things that the inherent characteristics of each symbol system does best and worst. Writing in a novel is particularly well suited for elaborating on introspection; speech in a stage play is particularly well suited for portraying the clash of personalities; filmic communication in an entertainment film is particularly well suited for simultaneously depicting the vastness of an invading armada and the tenseness which results from the buffeting of a ship by battle and storm.

Although a common rationale for the use of filmed demonstrations is that they give "every student a front seat," the problems connected with differential codification render this an over-simple assumption. For example, the Inquiry Training procedure developed by Suchman (1962) called for pupils to elicit information by appropriate questions with a minimum amount of information imparted directly by the instructor. In at least one case, though, there were film-dictated circumstances where this paradigm was distorted and the information imparted directly. "There are certain conditions in the episode that are not noticeable in the film but which would be immediately identified upon close examination of the apparatus" (p. 45). In general, however, there is no reason why a condition which would be immediately identified upon close examination could not be made clear in a film episode. The failure to do so is a coding failure resulting from inadequate attention to the problem of differential codification in making a transformation between direct experience and mediated experience.

Differential codification is implicated in any decision to use a particular symbol system in education yet there is at present little organized understanding of the structural characteristics of the symbol systems utilized in education. Although this is a broader topic than can concern us here, a brief discussion may serve useful illustrative purposes. Typically, lecture and discussion are grossly described in terms of their interactions, i.e., their transmission channel characteristics, leading to the paradox that "one man's 'lecture' is another man's discussion" (Wallen and Travers, 1963, p. 481). This paradox can be seen as resulting from the way in which each individual organizes the respective presentation. The benefits which are presumed to accrue from a discussion are not simply the consequences of permitting instructor-student interaction, but rather derive from imposed characteristics, i.e., the way in which the material is organized.

A similar explanation may be used to understand the problem cited earlier concerning the reading of a textbook from a podium or silently studying a lecture transcript. For reasons which are not clearly understood, speech and writing facilitate different types of imposed characteristics and specific symbol systems. The imposed characteristics of a textbook seems to differ sufficiently from the imposed characteristics of a lecture so as to make each less effective in some respects when transmitted through channels for which they were not designed: a person reading a book to a group and an individual studying a lecture transcript by himself. Sociologist C. W. Mills (1959) speculated that in a good instructional lecture the teacher should

> make very explicit the assumptions, the facts, the methods, the judgments. He ought not to hold back anything, but ought to take it very slowly and at all times repeatedly make clear the full range of moral alternatives before he gives his own choice. To write that way would be enormously dull, and impossibly self-conscious. That is the reason why very successful lectures do not print well (pp. 79-80).

In the absence of empirical evidence, this explanation of why lectures do not print well is as good as any other. Note, however, that Mills' definition of what is a good lecture is phrased in terms of imposed characteristics: "not hold back anything. . . take it very slowly . . . repeatedly make clear the full range of moral alternatives. . . ." Why this type of presentation becomes "enormously dull and impossibly self-conscious when printed" is the question at issue here. It may be that the explanation is no more complicated than the fact that speech is delivered at approximately 150 words per minute while reading occurs at a minimum of two to three times that speed. Or it may be that there are internal processing characteristics for speech and writing quite apart from speed of presentation. Whatever the explanation, it seems clear that the inherent and transmission channel characteristics are implicated as are the internal processing characteristics.

The failure to make the distinction between imposed and inherent characteristics or, more generally, consider the problems of differential codification is common to educational research. Much research which was presumably filmic research actually used film or television as a transmission channel for more broadly applicable specific symbol systems.

An example of the confusion between imposed and inherent characteristics is the research effort directed toward understanding the specific symbol system which consists of the use of relatively small, discrete bits of information of progressive difficulty constructed to elicit an immediate response and immediate reward or correction. This set of characteristics, called programmed instruction, may be transmitted through several channels: one person addressing a group, a set of sheets bound together for individual study, an individual mechanical device to expose bits of information one at a time, or information can be continuously projected on a screen or television monitor for a relatively large audience.

A number of studies have examined the application of programmed instructional techniques to filmic communication (e.g., Gropper, 1965; Kantor, 1960; Kendler, Cook and Kendler, 1953; Hirsch, 1952). There is nothing wrong with this type of study from the viewpoint of the general educational enterprise, but from our present viewpoint they are believed to contribute nothing to the understanding of filmic communication in education.

A more subtle example of the confusion between inherent and imposed characteristics can be found in the studies which allegedly examine the relative effectiveness of expository versus dramatic presentations (e.g., Blain, 1956; see also May and Lumsdaine, 1958, ch. 3). In these studies (and in many educational films) dramatic presentation is interpreted in terms of a gross description of one of the inherent characteristics of drama, i.e., dialogue. The benefits which are posited as accruing to the use of dialogue, "more interest . . . vicarious experience . . . identification" (May and Lumsdaine, 1958, p. 32), cannot be expected, on the basis of dramatic theory, to accrue to just any dialogue. The "most essential and inescapable characteristic [of the imposed structure of drama] is the presentation of a conflict of will" (Lawson, 1949, p. 160). An alternate description of the imposed structure of drama is that "drama gives us only the culminating points—or shall we say the intersecting culminations?—[of] two or three destinies" (Archer, 1937, quoted in Magowan, 1951).

Regardless of the fine points of dramatic theory, it seems clear that the essential quality of drama is not the inherent characteristic of dialogue, but rather some imposed structure which can be variously described. Dramatic dialogue is arranged in particular ways, for particular reasons in both stage and film productions. These purposes are only rarely expository and almost never (in modern drama) didactic. Socratic dialogue may have some benefits to bystanders, but it is problematic whether they are the ones suggested by May and Lumsdaine. On the basis of even this sketchy theory, there is no reason to expect differences between expository and dialogue versions of educational films and none has been found. The question of the role of dramatic presentation in education must be deemed to remain open.

VI

CODING TRANSFORMATION

Information processing: Earlier in this study, coding was defined as selectively structuring environmental data in such a way as to make it more easily usable, either immediately or at some future time. It was also pointed out that this definition could apply to cognitive processes or symbol systems. We have seen some of the ways in which symbol systems mediate the environment; now let us look at how this mediated experience relates to cognition; specifically, coding as a cognitive process.

One way of looking at mediated experience is as a form of external information processing, or precoding, for cognitive coding. When an experience is mediated, the structural characteristics of the symbol system can hinder or contribute to the internal processing quite apart from the content of the experience. Given any information, direct or mediated, individuals transform this information into usable data. When this transformation is the consequence of the inherent or imposed structure of a symbol system, in contrast to the content of the coding, it may be useful to refer to the process or result as a coding transformation. A particular direct experience may evoke a particular response. When this response is altered by the mediation of a symbol system, we have the operation of a coding transformation.

The concept of coding transformation is based on the well-understood idea that individuals bring their cognition and experience to the task of coding any new experience. The degree to which the new experience becomes part of the individual's cognition is a function of the match between the experience and the coding capacity of the individual. A coding transformation is effected when the structure of the symbol system mediates the direct experience in such a way as to render it more readily assimilated as part of an individual's cognition.

There are various degrees of agreement between external and internal information processing; what is missing in the one must be supplied by the other. Educated adult readers can process the sentence: Early retirement is a significant factor in one's physical development, pecuniary success, and intellectual stature. Such readers can transform the sentence into its more common rendering. Most grammar school pupils could not. A coding transformation would be required even though the substantive features of the experience being referred to (the content) are similar in both expressions.

Coding transformations are not limited to this simple form. They also seem to function in more complex relationships among symbol systems, cognition, and performance. Such interactions can be illustrated by experiments with the learning of digit series. While we are not here immediately concerned with the issues explored directly by these studies, they serve to illustrate a more general way of looking at coding that is important in understanding the functions of filmic communication.

In the learning of digit series, subjects apparently group the series for themselves, even if there is no grouping apparent in the stimulus. Thus a series administered as 61935827 is internally coded as 619-358-27 or some other subjectively imposed grouping. Under ordinary conditions the external or internal grouping of digits is a relatively trivial question for our purposes. Subjects can apparently impose the grouping and do so. Under conditions designed to hinder recall (e.g., speeded up presentations of the series), external grouping becomes crucial. External information processing must do what internal information processing cannot do (see Neisser, 1967, ch. 9).

The recall of individual digits can be influenced by the external grouping of the series. The first digit of a group is subject to greater transitional error than other positions; changing the external grouping will change the pattern of transitional errors. Given the series 2749563, the numbers 9 or 5 will exhibit different transitional error rates if the series is administered as 274-9563 or 2749-563 (Johnson, 1965).[12a]

The Johnson study illustrates what might be called intra-modal coding transformations, i.e., the imposed characteristics of a given mode (digital in this case) effect transformations which affect performance. An illustration of a more general class, cross-modal transformations, can be found in a study which explored the relationships between analogic and digital information involved in duplicating arrangements of disks in patterns (Essig, 1964). Subjects were given either digital or analogic instructions necessary to duplicate analogic patterns. In representing familiar, named arrangements, analogic and digital instructions were equally efficient. There were no errors in the use of analogic instructions while errors in the use of digital instructions increased with the complexity of the patterns.

[12a] Since this was written, Asch (1969) has published evidence with respect to a wider range of stimulus forms which "establish that objectively identical contents when differently related produce distinctive effects in memory and, by inference, at acquisition" (p. 96).

The theoretical interpretation of the Essig evidence is similar to the interpretation of the efficacy of externally imposed grouping of digit strings under difficult task conditions. At some fairly simple level of task complexity, information about the analogic task could be transmitted through a digital code and it was possible for subjects to make the transformation back into the analogic form necessary to perform the task. As the complexity of the task increased, the transformation between digital information and analogic task became more difficult for subjects with the consequent greater efficacy of the analogic information. Furthermore, within the digital information, it should have been possible to effect intra-modal transformations through the use of alternate types of digital instructions; alternate types of digital instructions should have resulted in differential performance.

A possible limiting case of cross-modal transformation is suggested by the study of color coding by Brown and Lenneberg (1954). Using one group, codability scores for twenty-four color chips were determined; on later testing with other groups it was found that those colors for which there was greater agreement on a name were more readily selected in a recognition task. Brown and Lenneberg interpreted these results as suggesting that words indicate perceptual categories with an increased frequency of verbal expression indicating a greater availability of a category.

To the extent that words are a convenient way of segmenting and referring to continuous phenomena, cross-modal transformations would then be dependent on the existence of socially agreed upon labels. Essig's evidence, however, suggests the existence of analogic perceptual categories in addition to the perceptual categories indicated by digital forms. This evidence and the evidence on the memory for pictures (e.g., Shepard, 1967) point to some form of cognitive organization which facilitates the processing of analogic information independently of digital labels. The open question then concerns the relative contributions of analogic and digital categories to information processing.

The position taken here is that the existence of a digital category probably supersedes the equivalent analogic category. A picture of a cat; the sound of meeow; the printed word, cat; and the spoken word, cat are all probably encompassed in a single category. However, it is argued that analogic categories and coding transformations become involved when the utterance becomes more complex along the analogic dimension or when the two sets of information are not redundant. The extent of this involvement relates to individual differences. Both classes of coding transformation are contingent on subjects' aptitudes.

These relationships are summarized in the main assertion of the present study: Sets of symbols (or more generally, signs) can be manipulated in particular ways which can supplement internal coding capacity with respect to particular tasks. The more general statement of this point has been repeated several times previously: coding through symbol systems facilitates or constrains cognitive coding. Subsequent sections will elaborate on this proposition.

Symbolic adequacy: A start toward this elaboration can be made by expanding the proposition as follows: For certain individuals with respect to certain phenomena, and certain phenomena with respect to certain symbol systems, coding through symbol systems facilitates and constrains cognitive coding. This cumbersome formulation attempts to summarize several related ideas: 1) individuals have differential capacities to encode experience; 2) symbol systems have differential capacities to encode experience; 3) symbol systems can aid or hinder encoding for individuals. Ideas similar to the first two propositions were expressed by Roger Brown (1966) as the distinction between coding ability and codability, where coding ability refers to the differential personal skill in coding while codability refers to the susceptibility of a referent being precisely encoded in a given language. The third proposition is a summary statement of the coding transformation concept.

Having made these distinctions, it is now possible to restate the argument in terms of coding of events by individuals of specified characteristics using specified symbol systems. Low codability may be seen as a general lack of coding ability as a consequence of the limitations of the symbol systems used for coding. Thus both coding ability and codability are instances of symbolic adequacy arising from the relationship of attributes in the environment, individual aptitudes, and the symbol system characteristics.

In order to maintain our focus on symbol systems as mediators between individuals and the environment, it may be useful to specify the notions of coding ability and codability as individual symbolic adequacy which emphasizes the probability of encoding and decoding by restricted classes of individuals while general symbolic adequacy emphasizes the probability of encoding and decoding by heterogeneous groups. In both cases, symbolic inadequacy may be supplemented by the use of another, more appropriate symbol system.

If we include the limitation that the manipulator of a symbol system makes those coding decisions that can be made, Brown (1956) was probably right when he said that any statement can be coded into any other language. The condition appended to Brown's assertion must be interpreted in a probabilistic sense that the manipulator of a particular symbol system is more likely to make certain types of coding decisions. This probability is constrained by the relative availability of certain categories in a symbol system and the coder's ability to manipulate these categories with respect to the environment.

Between languages the matter is quite straightforward. Brown argues that certain speakers of English, for instance, can make distinctions between types of snow that resemble the Eskimo distinctions. The important point, for our purposes, is that the speakers of English who make those distinctions are skiers and others concerned with snow. In other words, labels are applied to categories of experience that coders have learned to attend to. Between media the case is less clear. Even for those coders who have learned to attend to the appropriate attributes there is no unambiguous way in which film can express certain concepts, e.g., God, liberty, just as there is no unambiguous way in which language can express the characteristics of a spiral staircase, although it seems likely that an architect could do a better job of the latter than, say, a psychologist.

In summary, our original proposition can be restated as a formal definition of coding transformation: facilitation of cognitive processes through symbol systems which occurs when the characteristics of the symbol system supplement individual or general symbolic inadequacy.

If the concept of coding transformation is to have any utility at all it cannot be allowed to become a catchphrase for otherwise undifferentiated instructional effects. That a particular instructional technique is, or is not, effective is not per se evidence of coding transformations. The only way in which coding transformation as a concept can be useful is if it focuses on the particular set of contingencies which culminated in a particular instructional effect.

The elements in this contingent relationship are: 1) the instructional objective, 2) individual or general symbolic adequacy, and 3) the imposed and inherent structure of the symbol system. These relationships have not, to my knowledge, been systematically investigated.[13] But some of the elements have appeared in studies conducted for other purposes. Accordingly, a few selected examples will be chosen from the corpus of comparative media studies which have implications for such a systematic investigation.

Individual symbolic adequacy: A specific test of the "front seat hypothesis" was made by Tendam et al (1962) in a study evaluating the relative effectiveness of film versus live physics demonstrations. Experimental and control groups were randomly divided into four viewing distances with a maximum of 60 feet. At this distance in a live demonstration, one can barely see some of the apparatus much less make some of the required scale readings, which are normally announced by the instructor. In the film versions, the scales were displayed in extreme close up, permitting each student to make the reading in addition to hearing it stated as part of the narration. Other elements in the filmed versions were treated similarly; the attempt was to give each student a better than front seat view of the demonstration, contrasting in this way with Suchman's film which apparently neglected the filmic problems of image size, point of view, and sequence. Using criteria of scores on short quizzes and course grades, no effect was demonstrated for viewing distance in either the film or live demonstration conditions.

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[13] An interesting discussion of these elements which parallels the thinking of the present study can be found in Snow and Salomon (1968).

Another test of a common rationale in film utilization was made by Kanner and Rosenstein (1960). They hypothesized that color television would be more effective than monochromatic television in teaching a task involving color coding of electronic components. In the course of the lecture various relevant colors were referred to by the lecturer; only the experimental group was able to see the colors transmitted on a color television receiver while the control group received the identical lecture over a monochromatic television receiver. There was no significant difference in learning between the groups.

The theoretical defect of interest to us in both studies was a failure to consider relative symbolic adequacy with respect to analogic and digital information. Briefly, the argument is that words are adequate substitutes for some students for the class of common colors used in electronic color coding and for the class of data in physics demonstrations. No coding transformation can be expected as a consequence of the use of analogic information in those cases where decoders have available verbal equivalents to the analogic information, particularly when the verbal equivalent is also part of the presentation.

The differential effect of individual symbolic adequacy may be illustrated by the Kanner and Rosenstein (1960) finding that color presentations tended to be more effective with low ability students than with high ability students. The argument thus far suggests that for low ability students the color transmission performed, through coding, a transformation which the high ability students were capable of performing for themselves. High ability students had a greater degree of symbolic adequacy diminishing the importance for them of external coding. Furthermore, high ability students tended to perform better under the black and white condition adding an additional dimension, the contribution of internal coding to higher performance. This latter finding points to interpretations which will become important in a subsequent section. The external coding interfered with the high ability students' accustomed modes of processing or the necessity for performing the transformation internally involved the student in the learning task to a higher degree than would be the case where the transformations are given.

There have been a few studies which have been successful in manipulating inherent and imposed structure with results that are presumed to be coding transformations with respect to individual symbolic inadequacy. One of the best known and most detailed studies was Roshal's (1949) study which used knot tying as the instructional task. The study used eight treatments to manipulate a total of four variables: two coding variables, angle of view and movement; one content variable, the appearance of hands in the picture; and one instructional variable, participation.

The minor results indicated that: still pictures were less effective than motion pictures; the inclusion of hands in the still picture was less effective than a version which did not show hands; participation during instruction had no effect. The major result, from our viewpoint, indicated that under all other conditions, the use of a camera angle which shows the performance from the point of view of the performer (0° angle) was more effective than the use of a camera angle which showed the performance from the point of view of an observer (180° angle). These results are summarized in Table 1:

film version	mean score total knots tied	% correct knots tied					
		n	bowline	n	sheet bend	n	Spanish bowline
(0 -M- H- P)	1.192	(244)	58.7	(146)	35.1	(100)	25.5
(0 -M- H-NP)	1.108	(230)	54.2	(133)	31.1	(108)	25.5
(0 -S-NH- P)	.753		58.9		12.3		4.0
(0 -S-NH-NP)	.713		58.2		10.3		2.8
(0 -S- H- P)	.575		46.9		7.3		3.2
(0 -S- H-NP)	.554		43.9		8.2		3.4
(180-M- H-NP)	.469	(114)	25.6	(43)	10.3	(46)	11.0
(180-M- H- P)	.464	(103)	25.4	(68)	16.8	(17)	4.2
control			7.0		3.0		0.0

TABLE 1: SUMMARY CORRECT KNOTS TIED, MEAN SCORE TOTAL KNOTS TIED BY TREATMENT CONDITION (adapted from Roshal, 1949, table 3, p.22).

Another study which displayed the effect of coding transformation compared a film, a lecture, and a self-study manual for instruction in aircraft gunnery (Gibson, 1947). The film in this study also used performance point of view camera angle in addition to other filmic techniques which the investigators summarized as dynamic relationships and human relationships. The total scores, the scores for the top 30% and the scores of the lowest 30% for both immediate and two month repeated post test are summarized in Table 2:

	immediate post test			two month post test		
treatment	total	high 30%	low 30%	total	high 30%	low 30%
film	17.9	21.3	14.3	16.4	20.8	11.6
manual	15.4	20.1	10.3	13.0	19.0	7.1
lecture	15.2	19.8	9.8	13.6	19.8	7.8
control	5.4	10.0	1.6	7.0	12.7	2.9

TABLE 2: SUMMARY SCORES FOR TOTAL, HIGH 30%, LOW 30% ON IMMEDIATE AND TWO MONTH REPEATED POST TEST OF GUNNERY INSTRUCTION TREATMENTS (Adapted from Gibson, 1947, tables 10.1, 10.2, 10.3, 10.4, pp. 248-250).

Discussion of the third example is more hypothetical than the previous examples since it is based on a single, possibly deviant, finding. It is included because the apparent coding transformation is more complex than those manifested in the other studies. No overall difference in instructional effectiveness was indicated in a comparison of motion picture and filmstrip in the teaching of map reading reported in Hovland, Lumsdaine, and Sheffield (1949). On a single teaching point concerning the use of contour lines, the motion picture was significantly more effective.

In the motion picture this point was made by moving the camera from a horizontal to a vertical position relative to a mountain, illustrating the manner in which the contour of an elevation as normally viewed is superimposed on the distance dimension of a flat map. On a paper and pencil test, 28% of a control group answered this question correctly; 46% of the filmstrip group answered correctly and 64% of the motion picture group answered correctly. Both the motion picture and the filmstrip were effective in teaching this point to some greater than chance percentage of students, but a significantly larger percentage of students viewing the motion picture were able to correctly answer the relevant question. This finding is similar to the other examples where some greater than chance percentage of students manifested evidence of the instructional effect of even the least effective instructional technique.

There were thus in all three examples two levels of instructional effectiveness, significantly different from the control and from each other. The difference between the two successful groups is, in general, a function of the relative contributions of external and internal information processing; the subjects in the less effective treatment groups had to do more of the processing and fewer of the subjects in those groups were capable of the necessary transformations. This is further suggested by the relative differences between high and low scoring groups in the Gibson study and similar findings that showed low scoring groups gaining relatively more from the most effective treatment than high scoring groups.

Evidence of the implication of task complexity in the coding transformation can be found in the Roshal results. Comparing only the motion picture treatments, the simplest knot was tied successfully by approximately 45% as many subjects in the 180° angle treatment compared to the 0° angle treatment; this proportion decreases to 40% for the next most difficult knot and decreases to 30% for the most difficult knot. As the complexity of the task increased, the number of subjects who were capable of the transformation from observer's point of view to performer's point of view decreased. A similar interpretation is possible for the decrease between the simplest knot and the more complex knots for the still picture treatment. For the simpler knot it was not necessary to visualize the movement, for the more complex knots movement became so central to the coding transformation that the least effective motion picture treatment was more effective than the still picture treatment in instructing the tying of these knots.

General symbolic adequacy: Roshal interpreted his study as an explicit application of stimulus generalization principles while Gibson and his colleagues viewed the use of the point of view camera angle (= Roshal's 0° angle) as a substitute for direct experience: ". . . the film-trained group. . . had *vicariously experienced* the action of. . ." (Gibson, 1947, p. 252, italics in original). While these interpretations are adequate for the limited evidence they were applied to, they may not be quite broad enough to apply to other functions of filmic communication.

There are at least two other classes of transformation which would not be easily encompassed under a vicarious experience-stimulus generalization formulation. The first would include those examples which utilize the inherent characteristics of filmic communication, such as slow motion and time lapse photography, to modify direct experience. In these examples the transformation stems from the *dissimilarity* of the mediated experience to the direct experience. The compression or expansion of time in such examples is instructive precisely because it permits observations that are different from direct experience. Related to this class of physical transformations are conceptual transformations which present otherwise discrete direct experience in juxtaposition to facilitate conceptualization. Conceptual transformations are illustrated in a small way by the Hovland datum. The relationship between elevation and contour lines is a conceptualization not available as direct experience. It becomes experience in the Hovland motion picture through the use of one of the inherent characteristics of filmic communication in a particular imposed structure. Other, more complex, examples of this process will be cited below.

In general, both physical and conceptual transformations become experience only through the instrumentality of some symbol system, verbal, mathematical, visual, etc. Symbol systems facilitate cognitive processes in two general ways: symbol systems can mediate direct experience or they can create experience. In the one case the symbol system shapes and reports what could be available in the environment; in the other, the experience is available only through symbol systems. A physics demonstration, an interview with the Prime Minister of Great Britain, a flight in Apollo 9 are all continuous, direct experiences for somebody. The symbol systems report these experiences; symbol systems do not create them. On the other hand, *Alice in Wonderland*, *Citizen Kane*, and $\Sigma x^2 = \Sigma X^2 - \frac{(\Sigma X)^2}{n}$ are experiences that are available only through symbol systems. They are created by symbol systems.

Even for the encoder, the class of contrived experience exists only as an internal concept until it is externalized through symbol systems; there is no intermediate experience between the concept and its vivification as a particular presentation. In the vernacular, the encoder is in the position of the flustered little old lady who protested, "how do I know what I am going to say until I say it?"

Once having been encoded, a contrived experience becomes part of the class of mediated experience which is available to everyone. This is a common occurrence with traditional symbol systems. The concept of sums of squares was not available to anyone until an encoder formulated the relationships of *x*'s and *X*'s in the form now known to many college sophomores. This is a simplified account of a more complex process; what probably happened was that the concept was refined through several levels of mathematical complexity to its present simplified form. This, however, does not change the present argument that sums of squares became an experience only through a symbol system. In other words, the contrived experience is not otherwise available due to general symbolic inadequacy.

These considerations of individual and general symbolic adequacy suggest an answer to the question with which this study started: How can filmic communication contribute to those activities which should properly be the central concern of educators -- conceptualization, critical thinking, generalization, etc. Mediated direct experience is only a small part of the answer. A more general, but still small, answer would include simple contrived experiences. The most general answer must derive from all of the structural characteristics of filmic communication; its essentially inductive nature as well as its ability to manipulate time and space. The answer, in general, must be based on the capacity of filmic communication to lead students to the perception of unique experience or to the perception of experience in unique ways.

Before proceeding to discuss the educational relevance of the inductive nature of filmic communication it might be well to summarize the discussion so far in the following general hypothesis which will also be applicable to subsequent discussion: *The contribution of a symbol system to the attainment of an instructional objective is a function of* *the degree of transformation of experience by the symbol system relative to the student's ability to make the transformation for himself.*

If the foregoing analysis of structure and function has any validity at all, it points to a convergence between pedagogy and filmic theory based on the conceptions that underlay the educational developments variously called discovery, inquiry training, reflective teaching, hypothetical mode or, generically, inductive teaching. These instructional modes converge with the present analysis in viewing the communicative process as a joint enterprise between the communicator and the receiver which depends, in part, on the receiver's ability to, in Bruner's (1957) phrase, "go beyond the information given." As a general characteristic, in inductive teaching "the plan is to get students to discover things for themselves" (Panel, . . . , 1964, p. 6).

Some elements of this convergence can be indicated by a pair of quotes, one from a leading educational theorist, the other from a leading film theorist:

> The hypothesis I would propose here is that to the degree that one is able to approach *learning as a task of discovering something rather than "learning about" it*, to that degree will there be a tendency for the child to work with the autonomy of self-reward, or, more properly, be rewarded by discovery itself (Bruner, 1961, p. 24; italics added).

> . . . A work of art is the *process of the birth of an image in the spectator's senses and mind*. This is the trait of any really true-to-life work of art and the feature that distinguishes it from still-born works acquainting the spectator with the results of past creative process, instead of *involving him in the process as it occurs* (Eisenstein, 1939, p. 69, italics added).

The traditional approaches to educational film seem to be motivated by a desire to overcome the inherently inductive character of filmic communication. The attempt seems to be to acquaint students with the results of past processes rather than permitting them to learn as a task of discovering something by involving them in the process as it occurs. The most widely available form of films for education (i.e., the specific symbol system generally designated as "educational film") seem to be based on pedagogical theories such as reception learning where "the entire contents of what is to be learned is presented to the learner in final form" (Ausubel, 1963, p. 16).

There is essentially no empirical evidence based on controlled study related to this point; there are a few films made specifically for educational purposes which indicate the potential of using film in inductive teaching modes. The contrast between the two approaches can be illustrated by examples drawn from two films widely used for similar instructional purposes dealing with a similar topic, the life of a ten year old boy in a Negro ghetto. The excerpts are each approximately the same length, something less than two minutes in running time.

The first excerpt is from Portrait of a Disadvantaged Child: Tommy Knight (Vision Associates, 1965). The sequence starts with Tommy attempting to answer a teacher's questions:

> Tommy Knight is seen in a classroom trying to talk about farm animals -- and not succeeding. The next scene shows Tommy in a playground with his friends and succeeding in communicating perfectly well. The narrator tells us:
>
> > How can Tommy talk about a farm? What is a farm? For Tommy a farm is light years away from the streets, the houses, and the narrow limits of the world he knows. Tommy can't talk about a farm. And so he is labeled: Tommy is inarticulate and incapable of expressing even the simplest idea. While this may be a true picture of his situation in school it is not a true picture of Tommy.
> >
> > In a more familiar and comfortable environment, he expresses himself without any trouble at all and he makes himself understood.
> >
> > With his own group and on his own terms, Tommy is far from inarticulate; he knows how to speak and how to use words to communicate ideas, but he doesn't know how to do it on the school's terms and in the language and imagery of the strange and remote middle class world.

This isn't the worst part of the worst film available. It is a fair example of a widely used educational film form. In some ways it's a pretty good film; just on the basis of the images and accompanying dialogue the viewer could have discovered for himself some of the significant aspects of verbal communication among slum children but the narration makes explicit what is already clear. The real business of the film is transacted by the narration. The fully conceptualized narration imposed even on good pictures and dialogue limits the coding transformations to the one indicated by the language of the narration. Substantially the same effect would be possible by using the narration. This is similar to the problem of independent meaning discussed earlier. It is this kind of film which encourages passivity. If we tell students all there is to know we leave nothing for them to do but remember what we have told them.

The second excerpt is from The Quiet One (Meyers, 1948). As the sequence starts, the youngster, Donald, has suffered a disappointment. The narrator comments:

> He has failed again. The baby in him is desperate to be comforted.

We see a sidewalk tunnel in Central Park. Vaguely in the shadows we can see a woman and child; the child is upset and crys:

> Mamma, mamma, mamma. . . .

A well-dressed white woman and her pre-school daughter come into the light from the tunnel. The child is comforted by the mother. Donald passes by, looks back, and mimics the child:

> Mamma, mamma, mamma. . . .

As he enters the tunnel Donald's cry echoes:

> Mamma, mamma, mamma. . . .

Donald is next seen walking down a darkened apartment house hallway, the cry diminishes, becomes more plaintive:

> Mamma, mamma, mamma. . . .

He approaches a door and we hear him shout through the door:

> Mamma.

We see a shaft of light as the door opens. Donald's face lights up, anxious to please . We see a close-up of a woman's nervous hands; we see Donald again, crest-fallen this time. Then we see the mother and boy together; he is biting his finger nails. We hear the mother's grudging invitation:

> Well, come on in.

They pass through a kitchen where is pot is seen steaming on the stove. Only then does the narrator comment:

> It smells like home, but it's no home for you.

Immediately we hear a man's angry voice:

> You coming back in here or not?

The mother leaves; we hear an argument between the man and the woman. Donald is left alone.

It is a large but, I believe, a logically defensible leap between the transformations in the examples cited earlier and what is seen as a similar effect in The Quiet One. In the former cases the symbolic inadequacy was individual, in the latter example there is a general symbolic inadequacy. Although obviously more complicated, the process here is not in principle different from the transformation involved in teaching knot-tying from the point of view of performance with the qualifications implied in the discussion of Kanner and Rosenstein (1960) (see p. 53).

In that study there was a suggestion that too much transformation tends to hinder performance. In situations where the task is a relatively complex cognitive performance, excessive transformation may hinder precisely the processes we are attempting to develop. If anything, in this class of symbolic transformation it may be well to force the pace by taxing the processing capacity. The limit here is an empirical question, but the considerations of film literacy discussed earlier (see pp. 38-39) suggest that the internal coding capacity with respect to filmic communication may be greater for students than for their instructors.

Although students have apparently learned to process the multiple inputs from films even more complex than The Quiet One, it remains a useful example as one of the most sophisticated educational films available, despite its age; its contrast to Tommy Knight, made almost twenty years subsequently, is particularly enlightening. Whereas the narration in Tommy Knight is fully conceptualized leaving little for the audience to do, the narration of The Quiet One is a conceptual framework guiding the viewer through the images. The images are permitted to carry a good bit of the communication load; there is no easy way in which words alone could have done the same job. Perhaps the words of a James Baldwin or Claude Brown might; but even here, I'm not sure that words alone could convey the youngster's almost palpable distress. At each echoing of Mamma, mamma, mamma, there was a different quality to the sound. First a mocking of the white child, then an infant's plaintive cry, then a straightforward calling through the door. Words alone could not have conveyed this. The paralinguistic component of speech is an integral part of filmic communication and is one of the things that permits it to teach in new ways. Students must process all of the separate inputs and reach their own integration. Students here are active participants in the instructional process.

Coding transformations of this class are not limited to the affective domain. Some examples are available which perform substantive instructional tasks. For example, one of the more difficult concepts in teaching set theory to young children is the concept of an empty set. An animated film, Sets, Crows, and Infinity (Cornwall, 1962) attacked this problem by first explaining the elementary notion of sets by reference to a group of crows each of which collected a particular type of object; some crows collected round objects, others collected square objects, some collected red objects, others collected yellow objects. Some crows collected round red objects and one even collected pop corn. The concept of sets was thus defined simply in terms of the characteristics of the set. The idea of an empty set was illustrated (successfully, I am told by mathematics instructors) as the result of the crow who collected pop corn eating the elements in his set.

One more example of a film which combined inferential relationships and substantive instructional goals may help to make the point clearer. All My Babies (Stoney, 1953) was produced as a teaching film. The general purpose of the film was to teach proper techniques to Southern Negro midwives. The terms of Stoney's assignment included 118 points that the film had to make: "The midwife should be impressed with the dignity and responsibility of her calling. . . . The film should demonstrate the proper technique for using the sterile pack. . . the correct procedure for examining the placenta and reasons for said examination" (Stoney, 1958, pp. 81-82).

Instead of relying on the traditional "this is the way you do it" film-lecture, Stoney framed his story in terms of the experiences of one Georgia midwife who successfully followed all of the proper procedures. The film succeeded in both its training and attitude modification goals with Southern midwives; although midwives are playing a smaller role than previously, the film is now being widely used in obstetrics training in nursery schools and universities in the United States and abroad.[14] In its newer utilization, All My Babies still serves a combination of instructional-attitude modification goals; the attitude problem is no longer one of developing pride but of alleviating anxieties relating to childbirth in young nursing students. The film treats the whole childbirth process with a validity that enables young white girls in nursing schools to empathize with older Negro midwives and their patients. Even at the level of instruction one must ask is there didactic verbal coding adequate to describe childbirth? There are no words that can adequately encompass some experiences although we sometimes try.

All My Babies used inferential relationships in attaining both its attitude modification and instructional goals. Each of the 118 teaching points were set forth in terms of inference. It was not didactically stated that "this is the proper technique for using the sterile pack"; the technique and its importance were embedded into the story line. Students were not merely told of the importance of the sterile pack; they saw for themselves.

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[14] H. Mitchell, Technical Director, All My Babies, now Coordinator of Nursing Services, Health Conservation Branch, Georgia Department of Public Health, Atlanta, Georgia, Private communication, 1967.

For most purposes words are absolutely necessary to comprehend experience, but without some base in (direct or mediated) experience, words become meaningless or distorted. What kind of meaning does a sentence like the following have to middle class students? "In this atmosphere of hostility and rejection the disadvantaged child moves in a straight line away from the values of an education and away from the fulfillment of his potential as an intelligent, functioning human being" (narration from Tommy Knight, Vision Associates, 1965).

In cases where the individual possesses the requisites for appropriate linguistic coding, it is clear that language does the job better, faster, more efficiently. If one knows what red is, then no example is needed when the word is used. On the other hand, even if the word could be learned without experience, not much has been learned; even blind men can be taught the names of colors.

It is for this reason that the suggestion can be made that a key educational function of filmic communication can be to serve as a heuristic and integrative framework for internal coding of data. Filmic communication presents an order of experience which can render meaningful otherwise meaningless data and conceptualizations. The quote from Tommy Knight can have meaning if the student has previously acquired the requisite internal coding framework; films directed to supplementing general symbolic inadequacy can facilitate the development of this framework. The use of filmic communication in this way deals in addition with a problem that is central to the whole of educational enterprise -- the development of the learner's ability to learn for himself from the environment.

It has already been argued that through the unique coding techniques of filmic communication different image sizes can be manipulated for emphasis; words and sound can be presented in controlled contrast with visual images; an accumulation of detail or the juxtaposition of contrasting images and sounds may impart substance to a verbally presented concept; experiences can be contrived which offer opportunities that life or language by themselves cannot offer. In many educational films, the potential for a viewer reaching his own conclusion through inference from this kind of evidence is vitiated by the use of a fully conceptualized presentation rather than a conceptual framework which enables the viewer to make his own discoveries and put his own labels on what he is seeing.

There is no particularly rigorous evidence on these points; the filmic ordering of detail so that the audience is led to inferential leaps has been under-used and scarcely studied in educational film although it is common in other classes of film. One thing seems intuitively clear: filmic communication is essentially inductive; utilized in any other way it will contribute to the accomplishment of only the simplest instructional goals. When filmic communication is used in its own terms -- not as a substitute for a lecture presentation — we force students to make their own inferences and guide them to their own understanding of experience. And in the process, we contribute to the achievement of what should be the fundamental goal of education.

VII

CONCLUSIONS AND RECOMMENDATIONS

The dominant conclusion to be drawn from the foregoing analysis is that if we are to understand and use filmic communication in terms of its potential to teach in new ways it must be in full recognition of its inherent complexity. This is not to say that film is more complex than any number of other phenomena we have learned to deal with, but rather that simplified adaptations from existing theory and practice will continue to emphasize transmission channel characteristics. There is nothing essentially wrong with using a motion picture or television or film-strip or computer assisted instructional system to transmit traditional instructional modes; but it should be clear that this is the decision being made when the complexity of filmic communication is ignored or overlooked.

A related conclusion is that there are few propositions in filmic communication that are not at best debatable; we know very little about filmic communication, except, once again, as a transmission channel. The present study has been a very preliminary attempt at ordering this domain. A few points emerge most clearly:

1 - Filmic communication and language mediate the environment in different ways; the two symbol systems are not the same except at the most general level.

2 - The two symbol systems appear to make different kinds of demands on the inferential capacity of the viewer. Whether language and film make different kinds of demands on other aspects of internal information processing is an open question.

3 - The specific symbol systems, e.g., television, motion pictures, filmstrips, subsumed under the general symbol system of film differ in detail, primarily in transmission channel characteristics, but the fundamental research problems among them are similar.

While the above points may be prima facie evident, they are stated in this form to emphasize the nature of the task which would face anyone who would attempt to understand filmic communication in any of its specific forms. A paraphrase of the observations by George A. Miller (1962) cited at the very beginning of this report may be useful here: There is no quarrel with the approach which would emphasize the general similarities rather than the specific differences between language and film so long as we recognize that this approach treats only the simplest 1% of the problem.

It may well be, as some have argued, that there is no difference at base between the two symbol systems; for the present, the assumptions of differences would seem to be more useful. Certainly the contrary assumption has adduced little evidence that bears any resemblance to filmic communication as commonly perceived. Furthermore, anyone who would argue for similarity would have to present evidence or interpretation bearing on the apparent differences summarized in the foregoing logical analysis. A number of empirical and conceptual questions remain; among the most central are:

1 - How do content and expression interact? What is the effect of specified combinations of primary coding variable on the perception of content within a single shot? Do these effects differ for shots in serial juxtaposition?

2 - What are the dimensions constraining or facilitating various serial and lateral juxtaposition effects?

3 - In what ways do various forms of language alter perception of a given image; how do different images alter the perception of a given form of language?

4 - In what ways do specified transmission channel characteristics alter the perception of given coding?

5 - Under specified conditions, are there identifiable interactions among symbol system characteristics, individual aptitudes and instructional objectives, i.e., can coding transformations of varying complexity be systematically identified?

These questions are consciously framed as basic research questions, since we lack even minimum evidence on most of these points. They can be specified in terms of particular instructional problems, but if we are to avoid another period of frustration in "audiovisual" research we must begin to work in some theoretical framework which respects both the structure of the symbol system under investigation and the applicable psychological theories.

REFERENCES

Alpert, H. The Dreams and the Dreamers. New York: Macmillan, 1962.

Archer, W. Play-making: A Manual of Craftsmanship. New York: Dodd, Mead, 1937.

Arnheim, R. Film. London: Faber & Faber, 1933.

Asch, S. E. A Reformulation of the Problem of Associations. American Psychologist, 1969, 24, 92-102.

Ausubel, D. P. Psychology of Meaningful Verbal Learning. New York: Grune & Stratton, 1963.

Balazs, B. Theory of the Film. New York: Roy, 1953.

Bazin, A. The Virtues and Limitations of Montage (1957). In his What is Cinema? Berkeley: University of California, 1967. Pp. 41-52.

Berlyne, D. E. Structure and Direction in Thinking. New York: Wiley & Sons, 1965.

Blain, B. B. Effects of Film Narration Types and of Listenability Level on Learning of Factual Information. Unpublished doctoral dissertation, Indiana University, 1956.

Brown, R. W. Language and Categories. In J. S. Bruner, J. Goodnow and G. A. Austin, A Study of Thinking. New York: Wiley, 1956. Pp. 247-312.

Brown, R. W. Words and Things. Glencoe: Free Press, 1958.

Brown, R. W. From Codability to Coding Ability. In J. S. Bruner (Ed.) Learning about Learning. Cooperative Research Monograph No. 15. Washington: Office of Education, U. S. Department of Health, Education, and Welfare, 1966, Pp. 185-195.

Brown, R. W. and Lenneberg, E. H. A Study in Language and Cognition. Journal of Abnormal and Social Psychology, 1954, 49, 454-462.

Bruner, J. S. On Going Beyond the Information Given. In Contemporary Approaches to Cognition. Cambridge: Harvard University Press, 1957. Pp. 41-69.

Bruner, J. S. The Act of Discovery. *Harvard Educational Review*, 1961, *31*, 21-32.

Bruner, J. S. The Course of Cognitive Growth. *American Psychologist*, 1964, *19*, 1-15.

Bruner, J. S. *Toward a Theory of Instruction*. Cambridge: Belknap Press of Harvard University Press, 1966.

Cornwall, B. (Director). *Sets, Crows and Infinity* (a film), 1962. Available for rental from Syracuse University Film Rental Library.

Carroll, J. B. *Language and Thought*. Englewood Cliffs, N. J.: Prentice-Hall, 1964.

Deese, J. *The Structure of Associations in Language and Thought*. Baltimore: Johns Hopkins Press, 1965.

Eisenstein, S. (Director). *Battleship Potemkin* (a film), 1925. Available for rental from Museum of Modern Art Film Library, New York.

Eisenstein, S. A Dialectic Approach to Film Form (1929). In his *Film Form, Film Sense*. New York: Meridian Books Ed., 1957. Pp. 45-63.

Eisenstein, S. Montage in 1938/(1939). In his *Notes of a Film Director*. Moscow, USSR: Foreign Language Publishing House, n.d. Pp. 62-98.

Essig, L. C., Jr., An Exploratory Comparison of the Efficiency of Digital and Analogic "signs" in a directing behavior involving spatial relations. Unpublished doctoral dissertation, Indiana University, 1964.

Fodor, J. J., Jenkins, J J. and Saporta, S. Psycholinguistics and Communication Theory. In F. E. X. Dance (Ed.) *Human Communications Theory*. New York: Holt, Rinehart & Winston, 1967. Pp. 160-201.

Forsdale, J. R. and Forsdale, L. Film Literacy. *Teachers College Record*, 1966, *67*, 608-617.

Freeman, F. N. (Ed.) *Visual Education*. Chicago: University of Chicago Press (1924).

Fries, C. C. *The Structure of English*. New York: Harcourt, Brace, 1952.

Gibson, J. J. Motion Picture Testing and Research. Report No. 7, U. S. War Department, Army Air Force Aviation Psychology Research Reports. Washington: U. S. Government Printing Office, 1947.

Gleason, H. A., Jr. An Introduction to Descriptive Linguistics (Rev. ed.) New York: Holt, Rinehart & Winston, 1961.

Godard, J. L. (Director). A Bout de Souffle (Breathless) (a film). Available for rental from Brandon Films, New York.

Gould, J. TV Spies, Space and the Stagestruck. New York Times (Microfilm ed.) Friday, September 16, 1966, P. 73.

Gregory, J. R. Some Psychological Aspects of Motion Picture Montage. Unpublished doctoral dissertation, University of Illinois, 1961.

Gropper, G. A Behavioral Analysis of the Role of Visuals in Instruction. Report No. 1, Studies in Televised Instruction. Pittsburgh: Metropolitan Educational Television Station and the American Institute for Research, 1963.

Gropper, G. Controlling Student Responses During Visual Presentation. Report No. 2, Studies in Televised Instruction. Pittsburgh: Metropolitan Educational Television Station and the American Institute for Research, 1965.

Guilford, J. P. The Nature of Human Intelligence. New York: McGraw-Hill, 1967.

Heider, F. The Psychology of Interpersonal Relations. New York: John Wiley, 1958.

Heider, F. and Simmel, M. An Experimental Study of Apparent Behavior. American Journal of Psychology, 1944, 57, 243-259.

Hilgard, E. R. Teaching Machines and Creativity. Stanford [University] Today, 1963, 1, n.p.

Hirsch, R. C. The Effects of Knowledge of Test Results on Learning of Meaningful Material. Human Engineering Report, SDC 269-7-30, Port Washington, N. Y. Navy Special Devices Center, 1952.

Hoban, C. F. The Usable Residue of Educational Film Research. In New Teaching Aids for the American Classroom. Stanford, Calif.: Stanford University Institute for Communication Research, 1960. Pp. 95-115.

Hoban, C. F. and van Ormer, E. B. Instructional Film Research 1918-1950. Technical Report SDC 269-7-19. Port Washington, N. Y. Navy Special Devices Center, 1950.

Hoffman, H. F. Cutting off the Feet. Moving Picture World. April 6, 1912, 12, P. 53.

Hovland, C. I., Lumsdaine, A. A. and Sheffield, F. D. Experiments in Mass Communication, Princeton, N. J.: Princeton University Press, 1949.

Hughes, J. P. The Science of Language, New York: Random House, 1962.

Jacobs, L. The Rise of the American Film. New York: Harcourt, Brace, 1939.

Johnson, N. Linguistic Models and Functional Units of Language Behavior. In S. Rosenberg (Ed.) New Directions in Psycholinguistics. New York: Crowell-Collier and Macmillan, 1965. Pp. 29-65.

Journal of the University Film Producers Association. 16mm terms used in production of non-theatrical films (special ed.) Winter 1960, 12, 1-34.

Judson, A. J. and Cofer, C. N. Reasoning as an Associative Process: "Direction" in Simple Verbal Problems. Psychological Reports, 1956, 2, 469-476.

Kael, P. I Lost it at the Movies. Boston: Atlantic Monthly Press, 1965.

Kanner, J. H. and Rosenstein, A. J. Television in Army Training: Color vs. Black and White. A V Communication Review, 1960, 8, 243-252.

Kantor, B. R. Effectiveness of Inserted Questions in Instructional Films. A V Communication Review, 1960, 8, 104-108.

Kendler, T. S., Cook, J. O. and Kendler, H. H. An investigation of the Interacting Effects of Repetition and Audience Participation on Learning from Training Films. American Psychologist, 1953, 8, 378-379.

Kerrick, J. S. News Pictures, Captions, and the Point of Resolution. Journalism Quarterly, 1959, 36, 183-188.

Knight, A. The Liveliest Art. New York: Macmillan, 1957.

Knowlton, J. Q. A Conceptual Scheme for the Audio Visual Field. *Bulletin of the School of Education, Indiana University*, May, 1964, *40*, 1-42.

Kracauer, S. *Theory of Film*. New York: Oxford University Press, 1960.

Langer, S. K. *Philosophy in a New Key*. Cambridge, Mass.: Harvard University Press, 1942.

Lashley, K. S. and Watson, J. B. A Psychological Study of Motion Pictures in Relation to Venereal Disease Campaigns. Washington, D. C.: United States Interdepartmental Social Hygiene Board, 1922.

Lawson, J. H. *Theory and Technique of Playwriting*. New York: G. P. Putnam's Sons, 1949. (Republished: New York: Hill & Wang, 1960).

Lawson, J. H. *Film: The Creative Process*. New York: Hill & Wang, 1964.

Lindsay, V. *The Art of the Moving Picture*. New York: Macmillan, 1915.

Lumsdaine, A. A. Instruments and Media of Instruction. In N. L. Gage (Ed.) *Handbook of Research on Teaching*. Chicago: Rand McNally, 1963.

Macgowan, K. *A Primer of Playwriting*. New York: Random House, 1951.

Manis, M., Gleason, T. C. and Dawes, R.M. The Evaluation of Complex Social Stimuli. *Journal of Personality and Social Psychology*, 1966, *3*, 404-419.

May, M. A. and Lumsdaine, A. A. *Learning from Films*. New Haven: Yale University Press, 1958.

Mercer, J. Relationship of Optical Effects and Film Literacy to Learning from Instructional Films. Human Engineering Report SDC 269-7-34. Port Washington, N. Y.: Navy Special Devices Center, 1952.

Meyers, S. (Director) *The Quiet One* (a film), 1948. Available for rental from Purdue University Film Library.

Mialaret, G. *The Psychology of the Use of Audio-Visual Aids in Primary Education*. New York: UNESCO Publications Center, 1966.

Miller, G. A. Some Psychological Studies of Grammar. *American Psychologist*, 1962, *17*, 748-762.

Miller, G. A. Some Preliminaries to Psycholinguistics. American Psychologist, 1965, 20, 15-20.

Miller, N. E. (Ed.) Graphic Communication and the Crisis in Education. Washington, D. C.: National Education Association, 1957.

Mills, C. W. Sociological Imagination. New York: Oxford University Press, 1959.

Münsterberg, H. The Photoplay, a Psychological Study. New York: Appleton, 1916.

Neisser, U. Cognitive Psychology. New York: Appleton-Century-Crofts, 1967.

Osgood, C. A., Suci, G. A. and Tannenbaum, P. H. The Measurement of Meaning. Urbana: University of Illinois Press, 1957.

Panel on Educational Research and Development of the President's Science Advisory Committee. Innovation and Experiment in Education. Washington, D. C.: U. S. Govt. Printing Office, 1964.

Panofsky, E. Style and Medium in the Motion Pictures. Transition (Paris), 1937, 26, 121-133. (Reprinted in D. Talbot (Ed.) Film: An Anthology. New York: Simon & Schuster, 1959. Pp. 15-32.

Penn, R. An Experimental Study of the Meaning of Cutting-rate Variables in Motion Pictures. Unpublished doctoral dissertation, University of Iowa, 1967.

Perron, C. (Director). Caroline (a film), 1964. Available for rental from Contemporary Films, New York, Chicago, and San Francisco.

Pryluck, C. and Snow, R. E. Toward a Psycholinguistics of Cinema. A. V. Communication Review, 1967, 15, 54-75.

Pudovkin, V. I. Introduction to the German Edition, (1928). In his Film Technique, London: G. Newnes, 1933. (Republished: New York: Evergreen Original, 1958.)

Pudovkin, V. I. Types instead of Actors (1932). In his Film Technique. London: G. Newnes, 1933. (Republished: New York: Evergreen Original, 1958.)

Reisz, K. The Techniques of Film Editing. New York: Visual Arts Books, 1953.

Reitman, W. R. Cognition and Thought: An Information Processing Approach. New York: John Wiley, 1965.

Rose, E. D. Attitude as a Function of Discrepancy Resolution in Multiple Channel Communication. Unpublished doctoral dissertation, Stanford University, 1964.

Roshal, S. M. Effects of Learner Representation in Film-mediated Perceptual-motor Learning. Technical Report SDC 269-7-5. Port Washington, N. Y.: Navy Special Devices Center, 1949.

Roshal, S. M. The Instructional Film. In G. Finch (Ed.), Educational and Training Media: A Symposium. Washington, D. C.: National Academy of Sciences, National Research Council Publication 789, 1960. Pp. 114-121.

Rothkopf, E. Z. Some Theoretical and Experimental Approaches to Problems in Written Instruction. In J. D. Krumboltz (Ed.), Learning and the Educational Process. Chicago: Rand McNally, 1965. Pp. 193-221.

Ruesch, J. and Kees, W. Nonverbal Communication. Berkeley: University of California Press, 1956.

Rulon, P. J. The Sound Motion Picture in Science Teaching. Harvard Studies in Education, Vol. 20. Cambridge, Mass.: Harvard University Press, 1933.

Salomon, G. and Snow, R. E. Specification of Film Attributes for Psychological and Educational Research Purposes. A V Communication Review, 1968, 16, 225-244.

Sebeok, T. A. Coding in the Evolution of Signalling Behavior. Behavioral Science, 1962, 7, 430-442.

Selby, S. The Films of Clement Perron. Paper presented at the conference of the University Film Producers Association, University of South Dakota, August, 1967.

Shepard, R. N. Recognition of Memory for Words, Sentences, and Pictures. Journal of Verbal Learning and Verbal Behavior, 1967, 6, 156-163.

Shoemaker, D. H. An Analysis of the Effects of Three Vertical Camera Angles and Three Lighting Ratios on the Connotative Judgment of Photographs of Three Human Models. Unpublished doctoral dissertation, Indiana University, 1964.

Snow, R. E. and Salomon, G. Aptitudes and Instructional Media. A V Communication Review, 1968, 16, 341-357.

Spottiswoode, R. A Grammar of the Film. London: Faber & Faber, 1935.

Stoney, G. (Director) All My Babies (a film), 1953. Released by Center for Mass Communication, Columbia University Press.

Stoney, G. All My Babies: Research. In R. Hughes (Ed.) Film: Book I. New York: Grove Press, 1959. Pp. 79-96.

Suchman, J. R. The Elementary School Training Program in Scientific Inquiry. United States Office of Education, Title VII Project 216, 1962.

Tannenbaum, P. H. and Fosdick, J. A. The Effect of Lighting Angle on the Judgment of Photographed Subjects. A V Communication Review, 1960, 8, 253-262.

Taylor, C. W. & Williams, F. E. (Eds.) Instructional Media and Creativity. New York: John Wiley, 1966.

Tendam, D. J., McLeod, R. R. and Snow, R. E. An Experimental Evaluation of the Use of Instructional Films in College Physics. American Journal of Physics, 1962, 30, 594-601.

Travers, R. M. W. (Ed.) Research and Theory Related to Audiovisual Information Transmission. Salt Lake City: University of Utah Bureau of Educational Research, Interim Report. United States Office of Education contract 3-20-003, 1964.

Vision Associates (Producer) Portrait of a Disadvantaged Child: Tommy Knight (a film), 1965. Available for rental from Purdue University Film Library.

Wallen, N. E. and Travers, R. M. W. Analysis and Investigation of Teaching Methods. In N. L. Gage, Handbook of Research and Teaching, Chicago: Rand McNally, 1963.

Worth, S. Film as Non-Art. American Scholar, 1966, 35, 322-334.

Worth, S. Cognitive Aspects of Sequence in Visual Communication. A V Communication Review, 1968, 16, 121-145.

Zuckerman, J. V. Commentary Variations, Personal Reference, and Phase Relations in Instructional Films on Perceptual-motor Tasks. Technical Report SDC 269-7-4. Port Washington, N. Y.: Navy Special Devices Center, 1952.